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TITLE STUDY OF RATE, MICROBIOLOGICAL PROFILE AND RISK FACTORS OF SURGICAL SITE INFECTIONS, EVALUATING IMPACT OF PREVENTION STRATEGIES

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STUDY OF RATE, MICROBIOLOGICAL PROFILE AND RISK FACTORS OF SURGICAL SITE INFECTIONS, EVALUATING IMPACT OF PREVENTION STRATEGIES

ABSTRACT

Background: Surgical site infections (SSIs) remain a significant healthcare challenge despite advances in surgical techniques and infection control practices. This study investigated the prevalence rate , microbiological profile, and risk factors of SSIs while evaluating the impact of prevention strategies.

Methods: A prospective cross-sectional study was conducted at Santosh Medical College and Hospital, Ghaziabad, India, from August 2023 to July 2024. A total of 225 clinically suspected SSI cases from 3,280 surgeries were analysed using structured proforma for data collection. Swab/pus samples underwent Gram staining and culture, with bacterial identification and antimicrobial susceptibility testing performed using the VITEK automated system following CLSI 2023 guidelines.

Results: The overall SSI rate was 4.87% (160 culture-positive cases). *E. coli* was the predominant pathogen (40%), followed by *Staphylococcus aureus* including *MSSA* (20%), & *MRSA*(10.62%), and *Klebsiella species* (15%). Superficial incisional infections constituted 72.5% of cases, while deep incisional infections accounted for 27.5%. Significant risk factors for SSI included Type 2 diabetes mellitus ($p=0.002$), hypertension ($p<0.001$), COPD ($p=0.005$), anaemia ($p=0.04$), and smoking ($p=0.01$). Wound classification showed strong association with SSI development ($p<0.001$). Antibiotic resistance analysis revealed high resistance to cephalosporins and fluoroquinolones among Gram-negative isolates, while carbapenems and aminoglycosides demonstrated better efficacy.

Conclusion: This study identified key risk factors and microbial patterns in SSIs at a tertiary care hospital in India. The close monitoring of a comprehensive SSI prevention bundle contributed to maintaining the SSI rate within acceptable international benchmarks. These findings emphasize the importance of risk stratification, surveillance of local microbial profiles and antibiotic resistance patterns, and implementation of evidence-based prevention strategies to reduce SSI burden in surgical care.

Keywords: Surgical site infection, Antibiotic resistance, Risk factors, Infection prevention bundle, Microbiological profile, E. coli, Wound classification, Tertiary care hospital

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ABBREVIATIONS

1. **AIM** - Aim
2. **SSI** - Surgical Site Infection
3. **MRSA** - Methicillin-Resistant Staphylococcus Aureus
4. **E. coli** - Escherichia Coli
5. **S. aureus** - Staphylococcus Aureus
6. **P. aeruginosa** - Pseudomonas Aeruginosa
7. **K. pneumoniae** - Klebsiella Pneumoniae
8. **AMP** - Amoxicillin
9. **CRO** - Ceftriaxone
10. **PIP-TAZ** - Piperacillin-Tazobactam
11. **IMP** - Imipenem
12. **CHX** - Chlorhexidine
13. **VAN** - Vancomycin
14. **VITEK** - Automated Microbial Identification and Susceptibility Testing System

"STUDY OF RATE, MICROBIOLOGICAL PROFILE AND RISK FACTORS OF SURGICAL SITE INFECTIONS, EVALUATING IMPACT OF PREVENTION STRATEGIES"

INTRODUCTION

Wound infection occurs when organisms invade the body through tissue disruption caused by a failure in both local and systemic defences. This invasion can result in conditions such as cellulitis, lymphangitis, abscess formation, and bacteraemia. Specifically, infections that occur at the site of a surgical procedure are referred to as surgical site infections (SSIs).[1] These SSIs are characterized as infections that manifest within 30 days of surgery, or up to 90 days if a surgical implant is used and remains in the body after the procedure. SSIs may affect the superficial layers of the incision or the deeper tissues at the site of the operation.[2] The National Nosocomial Infection Surveillance Program categorizes SSIs into three types: superficial infections, deep incisional infections, and organ or space infections.[3]

Surgical site infections (SSIs) arise from various sources, including the patient's own normal microflora, microorganisms from the hospital environment, or those introduced during medical interventions. These infections can also result from conditions that compromise the integrity of the skin or mucosal barriers, such as specific diseases, trauma, or burns.[4] SSIs represent a significant concern within surgical practice, occurring in about 2% of all surgical procedures. They contribute to approximately 20% of all healthcare-associated infections. They are considered the third most frequent type of nosocomial infection, following urinary and respiratory tract infections.[2,5] Globally, the incidence of SSIs varies widely, reported to be between 19.4% and 36.5%. In India, however, the rate of SSIs is generally lower, ranging from 3% to 12% [6-8].[6-8]

Surgical site infections (SSIs) continue to be a prevalent issue, leading to increased patient suffering and death. They also extend the duration of hospitalization and escalate medical expenses. Several factors contribute to the risk of SSIs, such as prolonged hospital stays, obesity, diabetes, and smoking. The occurrence of these infections involves a complicated interaction of numerous variables. Typically, the infectious agents in postoperative wounds originate from the patient's own body. However, infections can also be introduced externally, often from the nasal or skin bacteria of the surgical team. These external infections are usually spread via the hands

of the surgeon or due to inadequate sterilization practices in the operation theatre, spanning preoperative, intraoperative, and postoperative procedures.[9]

Surgical Site Infection (SSI) remains one of the most common healthcare-associated infections and poses significant risks to patient health and healthcare costs. To address this, bundle care approaches have been developed to reduce the incidence of SSIs. A bundle is a set of evidence-based practices that, when executed together, significantly improve patient outcomes.

Key Components of SSI Bundle Care

1. Preoperative Preparation

- Antibiotic Prophylaxis: Antibiotics should be given prophylactically before surgery to prevent infections. The choice of antibiotic should be based on the surgical site, type of procedure and local patterns of antibiotic resistance.
- Skin Antisepsis: Proper skin preparation with antiseptic agent, such as chlorhexidine-alcohol, to reduce the microbial count on the skin surface.
- Hair Removal: If necessary, clippers should be used or depilatory cream rather than shaving with a razor to minimize skin abrasions.
- 2. Intraoperative Measures
- Maintaining Normothermia: Keeping the patient warm during surgery, as hypothermia can impair oxygen delivery to tissues and inhibit the proper functioning of immune cells.
- Glycaemic Control: Maintaining blood glucose levels during and after surgery to reduce the risk of infections, particularly in diabetic patients.
- Appropriate Surgical Technique: Ensuring that surgical techniques as gentle handling of tissues, effective hemostasis, and elimination of dead spaces to minimize tissue damage and reduce the duration of the operation.
- Antibiotic Management: Redosing of antibiotics intraoperatively for long procedures and stopping antibiotics within 24 hours after surgery end.

3. Postoperative Care

- Incision Care: Using sterile techniques for wound dressing changes and educating the patient on how to care for their wound at home.
- Surveillance: Regular monitoring of the surgical site after the operation for any signs of infection and prompt intervention if signs occur.

- Patient Education: Providing patients with detailed instructions on signs of infection to watch for, when to seek medical attention, and how to care for their wound.
- Control of Environmental Factors: Ensuring proper sterilization of instruments and maintaining a clean and controlled environment in operating rooms and patient recovery areas.

Implementation Strategies

- Education and Training: Regular training sessions for surgical teams and staff involved in preoperative and postoperative care to ensure adherence to the bundle.
- Audit and Feedback: Monitoring the compliance with the bundle components and providing feedback to the staff, which helps in maintaining high standards of care.
- Multidisciplinary Approach: Involving surgeons, anesthesiologists, nurses, and infection control specialists in the planning and implementation phases of the bundle care to ensure all aspects of patient care are covered.

Evaluation and Adaptation

- Outcome Measurement: Tracking rates of SSI across the hospital to evaluate the effectiveness of the bundle.
- Continuous Improvement: Using data from audits and outcomes to refine bundle components and implementation processes.

Various important elements can impact the likelihood of infection following surgery. These include the surgical techniques employed, the manner in which the skin is prepared before surgery, the timing and technique of wound closure, and the use of antibiotics as a preventive measure after certain surgeries. Additionally, numerous other factors also play a role in determining the risk of infection. Healthcare providers should take these into account at all stages of surgical care—before, during, and after the procedure.[10]

Today's surgeons bear the responsibility of managing infections effectively. This includes a thorough understanding of both aseptic and antiseptic techniques to prevent infections. Surgeons must also be proficient in the use of prophylactic and therapeutic antibiotics. Furthermore, they should be equipped to monitor and support the patient using advanced surgical methods, pharmacological treatments, and non-pharmacological aids.[11]

The present research was undertaken in a tertiary care Hospital, Ghaziabad, Uttar Pradesh, India, to determine the prevalence of surgical site infections (SSIs) and identify the risk factors associated with SSIs in patients who had undergone surgical procedures, including both elective and emergency surgeries.

Surgical site infections (SSIs) remain a significant challenge in the realm of healthcare affecting the overall outcome of surgical procedures. This study aims to thoroughly examine the incidence rates and microbiological profiles of SSIs across a diverse patient population undergoing various surgical procedures. Furthermore, it seeks to delineate the key risk factors that predispose patients to SSIs, thereby identifying potential targets for intervention. A critical component of this research involves evaluating the effectiveness of existing preventive strategies implemented within hospital settings to mitigate the occurrence of these infections. By integrating a comprehensive review of patient demographics, surgical types, and pre-and post-operative care protocols, this study intends to provide actionable insights that could lead to enhanced infection control practices, ultimately improving patient outcomes and optimizing surgical success rates. Through this multifaceted approach, the research aspires to contribute valuable data to the ongoing efforts aimed at reducing the burden of surgical site infections within the medical community.

NEED FOR STUDY

The need for this study arises from the significant clinical and economic burden posed by surgical site infections (SSIs), which are among the most common healthcare-associated infections, leading to increased morbidity, prolonged hospital stays, and higher healthcare costs. Despite advancements in surgical techniques and the implementation of prevention strategies, the incidence of SSIs remains concerning, with varying rates across different healthcare settings. Understanding the microbiological profile and identifying key risk factors associated with SSIs is critical for tailoring effective preventive measures. Moreover, evaluating the impact of current prevention strategies, such as antibiotic prophylaxis, surgical site preparation, and postoperative care, can provide valuable insights into their efficacy, guiding evidence-based improvements in infection control protocols. This study is essential to reduce SSI rates, improve patient outcomes, and optimize healthcare resource utilization.

AIM AND OBJECTIVES

AIM: STUDY OF RATE, MICROBIOLOGICAL PROFILE AND RISK FACTORS OF SURGICAL SITE INFECTIONS, EVALUATING THE IMPACT OF PREVENTION STRATEGIES

OBJECTIVES:

- To study the prevalence rate of SSI.
- To study the risk determinant factors among the Post operative patients.
- To identify the microorganisms from the swab and pus samples in postoperative patients.
- To analyse the antibiotic resistance pattern of the isolates.
- To assess implementation and effectiveness of various prevention strategies.

REVIEW OF LITERATURE

Surgical site infections are the most common type of hospital-acquired infections among patients undergoing surgery. Historically, prior to the development and acceptance of the germ theory of disease, which highlighted the importance of microorganisms in causing infections, the rates of infections following surgery were exceedingly high. This often led to severe consequences, including the necessity for limb amputations or even death. The introduction and implementation of antiseptic methods have greatly improved outcomes for surgical patients, substantially reducing the incidence of postoperative infections.[12-18]

Surgical site infections (SSIs) play a significant role in increasing both morbidity and mortality after surgery. Recent statistics indicate that these infections account for more than two million hospital-acquired infections annually in the United States.[19-22] According to guidelines from the Centre for Disease Control and Prevention (CDC), SSIs are divided into several categories: superficial incisional SSIs, deep incisional SSIs, and organ/space SSIs. An SSI is confirmed if a surgeon either identifies the infection or has to reopen the surgical site. These infections are classified as SSIs if they occur within 30 days of the operation, or within one year if an implant is placed during the surgery. For a comprehensive breakdown of SSI categories, the CDC's National Healthcare Safety Network (NHSN) Patient Safety Component Manual, updated in January 2023, offers detailed information and guidelines.

Superficial Incisional Infections:

Surgical site infections that only involve the skin and the tissue just below it account for more than half of all surgical site infections. To diagnose a superficial incisional surgical site infection, at least one of the following criteria must be met:

- The surgical site shows signs of pus discharge.
- A microorganism is isolated from the fluid or tissue of the surgical site.
- The surgeon clinically identifies an infection at the surgical site.
- The surgeon has intentionally opened the wound due to signs of infection, which must be accompanied by at least one symptom like swelling, redness, localized pain, or warmth.

Deep Incisional Infections:

Infections that affect the deeper layers of skin, extending into subcutaneous tissues, muscles, and fascial planes, require specific diagnostic criteria to confirm their presence. To diagnose such infections, at least one of the following must be evident: the presence of pus discharging from the surgical site, the surgical wound splitting open on its own or being deliberately opened by a surgeon due to suspected infection, or the detection of an abscess or deep tissue infection on a computed tomography (CT) scan. Additionally, there should be at least one symptomatic indication of infection such as fever, localized pain, or tenderness. This detailed explanation clarifies the criteria necessary for diagnosing deep soft tissue infections.

Organ/Space Infections:

These infections can affect any body part or anatomical area that is deeper than the incision site, including the layers beneath the muscle or fascia, and may also involve infections related to any implanted medical devices. To diagnose such infections, one of the following criteria must be met:

1. There is purulent discharge from a surgical drain that has been placed into the affected organ, space, or cavity.
2. A microbial organism is isolated from a culture taken from the involved organ, cavity, or an associated abscess.
3. An abscess or infection in the organ, cavity, or specific anatomical area is detected through imaging techniques like a CT scan.

It is important to note that a wound is not classified as infected if the issues are limited to a stitch abscess, localized cellulitis, or a superficially infected stab puncture.

Most infections at surgical sites arise from the patient's own natural flora, which is typically present on the skin, mucous membranes, or within hollow organs. Infections are more likely to develop when the concentration of these microorganisms exceeds 10,000 per gram of tissue.[23]

Aetiology :

Postoperative wound infections arise from various sources, including direct or airborne contact and the invasion of endogenous bacteria. The likelihood of infection is affected by multiple elements. Variations in infection rates may occur depending on the type of surgery, the surgical technique employed, and the location where the surgery is

performed. The risk factors related to these infections can be divided into those associated with the patient and those linked to the surgical procedure itself.

The patient-related risk factors for surgical site infections encompass a range of conditions such as older age, nutritional deficiencies, low blood volume, excessive body weight, the use of steroids, diabetes that is not well-managed, weakened immune systems, smoking habits, physical injuries, the specific site of the procedure (such as the abdomen, pelvis, or limbs), prolonged stays in the hospital before surgery, poor skin cleanliness before surgery, and pre-existing infections at other body sites.

It is possible to improve certain conditions before surgery to reduce the risk of infection. These preparatory measures include quitting smoking, reducing weight, correcting blood clotting abnormalities, better managing blood sugar levels, and managing other existing health conditions.

Factors related to surgical procedures that pose risks include the following:

1. Formation of abnormal fluid accumulations, such as haematomas or seromas, which may complicate the healing process.
2. Contamination risks associated with the surgical environment, including the site, equipment, or personnel involved.
3. The use of drains, which while sometimes necessary, can be a potential source for introducing infections.
4. The introduction of foreign materials at the surgical site, which can interfere with natural healing processes.
5. The occurrence of hypothermia during surgery, which can impair immune function and wound healing.
6. Improper practices in hair removal at the surgical site that can increase infection risks.
7. Inadequate use of antibiotics prior to surgery to prevent postoperative infections.
8. Incomplete or improperly applied skin preparations that can fail to adequately sterilize the surgical area.
9. Insufficient duration for preoperative surgical scrubbing, potentially leaving harmful microorganisms on the skin.
10. Extended lengths of surgical procedures, which can increase the exposure to potential contaminants.

11. Suboptimal ventilation in the operating room, which could lead to a buildup of contaminants.
12. A history of prior infections or handling of contaminated cases that could influence current surgical outcomes.
13. Lengthy perioperative inpatient stays, increasing the exposure to hospital-acquired infections.
14. Inadequate surgical techniques, including:

- Neglect in maintaining tissue hydration through periodic saline irrigation, which is crucial for tissue viability.
- Direct injury to organs or tissues during the procedure.
- Application of excessive tension during tissue traction or closure, potentially impairing blood flow and healing.
- Over-traumatization of tissues during surgery.
- Failure to excise necrotic or dying tissue, which can serve as a focus for infection.
- Incomplete haemostasis, leading to ongoing bleeding and potential complications.
- Leaving excessive dead space, which can become a site for fluid accumulation and infection.
- Overuse of cautery, which can damage tissues and impair healing.
- Tissue devascularization, where blood supply to tissues is inadequately preserved.
- Accidental spillage of bowel contents, which can lead to contamination and infection.
- Unnecessary or extended use of surgical drains, which may prolong exposure to potential infection sources.[24-27]

The importance of following a detailed preoperative and operative checklist cannot be overstated, as it plays a crucial role in reducing the incidence of surgical site infections. It is the collective responsibility of the operating room staff to ensure compliance with these best practices. Ensuring proper ventilation within the operating room is critical; this is achieved by maintaining positive pressurization coupled with effective filtration, flow, and air exchanges, ideally at a minimum of 15 exchanges per hour. It is essential

that the incoming air is HEPA filtered and sourced directly from outside, entering the room from an elevated position, either from the ceiling or high up on the walls, with exhausts placed near the floor to optimize airflow dynamics.[28,29]

To minimize the risk of infection, it is advisable for patients to use a chlorhexidine-based antiseptic solution during a shower the night before, as well as on the day of the surgery. For hair removal, clippers are recommended and should be used immediately before the operation to minimize any potential skin trauma, except in cases of scrotal surgery where their use is discouraged due to the heightened risk of excessive skin damage. For most surgical procedures across various specialties, the use of chlorhexidine combined with alcohol-based agents for skin preparation is typically favoured and recommended.

To minimize the risk of bacterial contamination, it is essential to routinely clean medical tools and accessories such as stethoscopes, blood pressure cuffs, patient transfer slides, tourniquets, and computer keyboards. This practice should be consistently applied to maintain a sterile environment.[30-34] Similarly, surgical equipment, including anaesthesia and cautery units, suction machines, operating room lights, and patient transfer aids, should be meticulously managed to avoid becoming sources of contamination. Items like towels and sheets should be kept in closed storage or outside the operating area to ensure cleanliness.

Implementing thorough scrubbing practices and the use of double gloving are recommended strategies to decrease the likelihood of postoperative infections.[35]Additionally, the World Health Organization (WHO) has developed a surgical safety checklist that promotes effective communication and procedural adherence, aimed at preventing complications and enhancing the overall safety and outcomes of surgical interventions. This checklist is particularly valuable in stratifying surgical procedures into four categories: clean, clean-contaminated, contaminated, and dirty-infected, which helps in assessing and managing the risks of postoperative wound infections effectively.

The classification system outlined by the Canadian Agency for Drugs and Technologies in Health (CADTH) in their 2011 Report distinguishes surgical procedures into four categories based on the level of sterility and potential contamination:

Clean: This category is used for procedures where there is no inflammation and sterility is maintained throughout. The procedure does not involve interacting with the gastrointestinal, urogenital, or pulmonary tracts.
Clean-Contaminated: These procedures involve accessing the gastrointestinal, urogenital, or pulmonary tracts under controlled conditions where there is no pre-existing contamination.

Contaminated: This classification applies to procedures where there is either a violation of sterile technique, significant spillage from the gastrointestinal tract occurs, or the procedure involves cutting through tissue that is acutely inflamed but not producing pus. Additionally, open traumatic wounds that have been present for 12 to 24 hours are included in this category.

Dirty or Infected: Procedures in this category are performed on perforated organs or where the incision is made through tissue that is both acutely inflamed and contains pus. This category also includes old traumatic wounds (over 24 hours) that have developed necrotic tissue or are contaminated with faecal matter.[36]

Epidemiology:

Between 0.5% and 3% of patients who undergo surgery are likely to experience a surgical site infection.[37]With the rise in outpatient surgeries, it has become increasingly difficult to collect complete postoperative data. In response, the National Healthcare Safety Network (NHSN) has begun implementing new protocols aimed at gathering information on surgical site infections that occur following procedures at ambulatory surgical centres. It's important to recognize that these infections can appear after the patient has left the ambulatory surgical centre or been discharged from the hospital. Often, the details of these infections are only recorded in outpatient records, which might not be consolidated with the hospital's main records. As a result, any surgical site infection data provided by the Centre for Disease Control and Prevention (CDC) and NHSN should be considered with an understanding of these limitations.

Even with the implementation of more rigorous preventive strategies, surgical site infections (SSIs) continue to substantially influence patient outcomes, contributing to both morbidity and mortality. These infections account for approximately 20% of all healthcare-associated infections.[38,39] Individuals who suffer from SSIs are more likely to need care in an intensive care unit (ICU) and face a mortality risk that is between 2 and 11 times higher compared to those without such infections. Furthermore, patients with SSIs are also five times more likely to be readmitted to the hospital. Indeed, SSIs are the leading cause of unexpected hospital readmissions following surgery.[40-43]

In 2018, data indicated that there were 157,500 cases of surgical site infections (SSIs) in the United States, leading to approximately 8,205 deaths. Notably, in intensive care units, SSIs were responsible for 11% of all fatalities. On average, a patient with an SSI spends an additional 10 to 11 days in the hospital, resulting in increased healthcare costs of over $20,000 per hospital admission. The cumulative impact of these infections on the U.S. healthcare budget is estimated to be around $3.3 billion each year.[38,44]
The likelihood of a surgical site infection is closely associated with the level of contamination present in a surgical wound at the time the operation is performed.[45,46]

Pathophysiology:

The initial step in the development of a surgical site infection is generally triggered by the contamination of the wound with microbes. The likelihood and severity of an infection are influenced by factors such as the virulence and the number of contaminating microbes, often quantified as exceeding 10^5 microorganisms per gram of tissue in the absence of a foreign body. The causative agents of surgical site infections can be categorized as either endogenous or exogenous. Endogenous microbes are those that originate from the patient's own body, such as the skin, mucous membranes, or internal organs like the hollow viscera, and can also be introduced through the bloodstream. The predominant endogenous microbes vary with the type of surgery; for example, Staphylococcus aureus and coagulase-negative staphylococci are commonly implicated in infections following cardiac, breast, ophthalmic, orthopaedic, and vascular surgeries. In contrast, surgeries involving the abdominopelvic region typically see infections caused by organisms such as Enterococcus, gram-negative bacilli, and anaerobes.

On the other hand, exogenous microbes are those introduced from external sources such as the operating room environment, including airborne particles, surgical instruments, and materials, or transferred by the medical staff. *Staphylococci* and *streptococci* are among the exogenous organisms frequently identified in surgical site infections. There is a growing concern about the increasing prevalence of more virulent, hospital-acquired organisms like Methicillin-resistant Staphylococcus aureus (MRSA) and microbes producing extended-spectrum β-lactamases. This trend is believed to be linked to the extensive and occasionally inappropriate use of broad-spectrum antibiotics. Research from community hospitals in the southeastern United States has shown that the rate of MRSA in surgical site infections climbed from 12% in 2000 to 23% in 2005. Additionally, a 2010 update from the National Healthcare Safety Network (NHSN) indicated that MRSA was responsible for 43.7% of surgical site infections.[23,47]

Various Microorganisms causing surgical site infections

1**. Staphylococcus Aureus**[23,47]

A gram-positive bacterium, often as a commensal on the skin and nasal passages of healthy individuals. Capable of causing a wide range of infections, from minor skin infections to life-threatening diseases like pneumonia, meningitis, and sepsis. It produces various toxins and has mechanisms to evade the immune system. Methicillin-Resistant Staphylococcus aureus (MRSA) is particularly notorious for its resistance to multiple antibiotics, making it a challenging pathogen in both hospital and community settings.

2. **Enterococci**

These are gram-positive cocci that are part of the normal intestinal flora. They can cause a range of infections, including urinary tract infections, bacteremia, and endocarditis, particularly in immunocompromised patients or after abdominal surgery. Notable for high-level resistance to many antibiotics, including vancomycin-resistant enterococci (VRE), posing significant challenges in healthcare settings.

3. **Escherichia coli**

A gram-negative bacterium found in the intestinal tract of humans and animals. It causes predominantly urinary tract and abdominal infections. E. coli is a major cause

of postoperative infections in abdominal surgeries. Some strains have acquired resistance to commonly used antibiotics like fluoroquinolones and cephalosporins.

4. **Pseudomonas aeruginosa**

A gram-negative, rod-shaped bacterium known for its robust nature and ability to thrive in diverse environments. Particularly cause nosocomial infections including surgical site infections due to its ability to survive in hospital environment and its intrinsic resistance to many antibiotics. Notoriously resistant to multiple types of antibiotics, often requiring combination therapy for treatment.

5**. Klebsiella species**

Gram-negative bacteria that are part of the normal flora of the mouth, skin, and intestines. Can cause a variety of infections including pneumonia, bloodstream infections, wound infections, and meningitis. Known for causing deep tissue infections post-surgery. Develops resistance, including production of extended-spectrum beta-lactamases (ESBLs), making them highly resistant to beta-lactam antibiotics.

6. **Proteus species**

Gram-negative bacteria, noted for their distinctive ability to highly produce urease. Commonly causes infections in wounds and burns, and is also associated with urinary tract infections due to its ability to produce kidney stones. Some strains have developed resistance to commonly used antibiotics, complicating treatment

7. Candida species and Molds

A genus of yeasts that can become pathogenic in immunocompromised individuals or in disrupted microbial environments.

Causes infections ranging from superficial mucosal infections to life-threatening systemic infections. Some species, like Candida auris, are emerging as multi-drug-resistant pathogens in healthcare settings.

Aspergillus species- Some species of Molds like Aspergillus fumigatus, Aspergillus Flavus

Molds that can be found in the environment. Mostly affects individuals with weakened immune systems or lung diseases, causing aspergillosis, which can be a life-threatening

infection. Resistance can vary, with some species being more challenging to treat due to innate resistance to common antifungal agents.

History and Physical Symptoms:

Symptoms indicative of surgical site infections typically appears within three to seven days post-surgery. Nevertheless, the guidelines stipulate that these symptoms must present within either 30 or 90 days following the surgery, depending on the type of surgical intervention undertaken. The specific timeframe for symptom manifestation is directly influenced by the nature of the surgical procedure performed.[48]

Surgical procedures that require monitoring for up to 90 days post-operation for possible surgical site infections include a variety of surgeries such as breast surgery, cardiac operations, both forms of coronary artery bypass grafts (with chest and donor site incisions or with chest incision only), craniotomy, spinal fusion, open reduction of fractures, herniorrhaphy, hip and knee prostheses placements, pacemaker implantations, peripheral vascular bypass surgeries, and ventricular shunt placements.

Surgical interventions that are technically complex, unusually prolonged, contaminated, or conducted on an emergency basis are generally associated with a higher risk of developing surgical site infections. Patients affected by superficial or deep incisional infections often experience a slow onset of pain near the surgery area, coupled with feelings of general weakness or lethargy. Such patients might report drainage from the incision or a need to change dressings more frequently than usual. Those suffering from organ/space infections typically report localized or widespread pain and may exhibit systemic symptoms like fever, chills, night sweats, fatigue, and malaise. On physical examination, signs such as redness around the incision, both pus-filled and clear discharge, wound separation, or slow healing might be observed. The area may be tender to touch, either at specific points or more broadly across the area.

It is preferable to conduct a physical examination of a patient suspected of having a surgical site infection in person. If direct examination is not feasible, then visual inspection of the affected area becomes crucial. Research has shown that employing wound photography when in-person assessments are not possible enhances diagnostic accuracy and aids in avoiding unnecessary treatments.[49]

During the physical examination, it is essential to remove any dressings to fully inspect the wound for any blisters, tension, swelling, unusual sensitivity, pronounced redness, soft spots, discoloured tissue, and signs of reduced blood flow or tissue death. Using sterile procedures, the wound should be palpated carefully. Any openings, whether deliberate or accidental, must be explored with a sterile cotton swab to check for any internal cavities, integrity of deep sutures, accumulations of fluid, and undercuts in the tissue. If any discharge is present, it should be collected for laboratory testing to determine its type and sensitivity to antibiotics, and for a thorough microbiological examination.

Evaluation:

Identifying a surgical site infection primarily relies on clinical judgment. Nonetheless, obtaining wound cultures is crucial for pinpointing a causative organism and directing appropriate antibiotic treatment. Advanced imaging techniques such as ultrasound, computed tomography (CT), or magnetic resonance imaging (MRI) prove beneficial when there's a suspicion of a deep-seated infection. Various tools and models have been developed to assess the risk of infection based on specific risk factors. Notable among these are the National Nosocomial Infection Surveillance System, the Australian Clinical Risk Index, and the European System for Cardiac Operative Risk Evaluation. Despite their widespread recognition, these models often fall short as they do not account for numerous risk factors and tend to have limited predictive power, particularly in discriminating between different types of surgeries. In response, more tailored scoring systems are being developed to address these gaps, including the two-variable Infection Risk Index in Cardiac Surgery and the Surgical Site Infection Risk Score, which offer more specific assessments for particular operations.[50-53]

Patients presenting with superficial incisional infections often do not exhibit systemic signs indicative of infection. Nonetheless, manifestations such as fever and an elevated white blood cell count might still occur. Utilizing imaging techniques for the diagnosis of these superficial infections is generally considered unnecessary and not advised. In contrast, patients suffering from deep incisional infections more frequently show systemic signs of infection, including fever. Laboratory tests in these cases usually reveal an increase in white blood cell count with a shift to the left, and elevated levels of procalcitonin and C-reactive protein may also be noted, although these markers are

not crucial for diagnosing. While superficial incisional infections can be diagnosed with relative ease, diagnosing deep incisional infections based solely on clinical observations can be challenging, particularly in obese individuals. Using ultrasound or CT imaging can aid in determining the depth, scope, and specific anatomical areas involved. Conducting image-guided aspiration and drainage, followed by culturing, can assist in selecting appropriate antibiotic treatments and enhancing patient outcomes.[54-56]

For organ/space surgical site infections, patients typically exhibit systemic inflammatory and infectious symptoms, even though the superficial incision might not show signs of infection. Diagnosing these infections reliably necessitates imaging that often reveals fluid accumulations or abscesses near or within the surgical area. Similar to deep incisional infections, utilizing image-guided aspiration provides clinical value. Consulting interventional radiology can be beneficial to evaluate the appropriateness of placing a drain.[57,58]

Treatment / Management:

Preventive Measures

To minimize postoperative infections, it is essential to follow preventive measures across various surgical phases, guided by the "CDC and Health Infection Control Practice Advisory Committee Guideline for the Prevention of Surgical Site Infections," published in 2017. This guideline divides the measures into pre-procedural, perioperative, and intraoperative phases. In the pre-procedural phase, it is crucial to optimize chronic health conditions such as glucose levels and medication regimens, and address any existing chronic wounds or infections, as well as encourage smoking cessation. During the perioperative period, strategies may include preoperative showers, hair clipping, administering operation-specific antibiotics, and proper skin preparation. Maintaining optimal conditions in the operating room, such as temperature control, air circulation, and sterility, is also vital for infection prevention.[59]

Research from Japan has shown a notable decrease in surgical site infections through the integration of a perioperative oral hygiene regimen, which involves tartar and plaque removal, professional dental cleanings, and, if necessary, dental adjustments and extractions. In a separate study, changing surgical gloves and instruments just before

closing abdominal wounds led to a reduction in infection rates, although further research is needed to confirm these findings.[60,61]

The routine use of surgical drains is generally not recommended due to the lack of clear evidence of their effectiveness in infection prevention and potential interference with early patient mobilization. However, if used, it's advisable to remove them promptly. Other interventions, such as antibiotic irrigation, use of topical antimicrobial gels, antibiotic-impregnated suture materials, and antiseptic dressings have been explored, but definitive evidence of their effectiveness is still lacking.[62-64]

Delayed primary closure is sometimes used in highly contaminated cases to reduce infection risks, but meta-analyses have not shown a significant clinical benefit from this practice. Tailoring antibiotic selection based on the surgical procedure and likely pathogens is also crucial for preventing infections.[65,66]

The application of prophylactic negative pressure therapy on post-surgical wounds is considered for high-risk and contaminated cases.[67,68] While generally supported by data, the effectiveness varies, influenced by the level of wound contamination and specific patient and wound characteristics.[69,70] The choice of surgical dressings for closed incisions has not shown a significant impact on infection rates.[71] Nevertheless, prophylactic wound protectors used during procedures like laparoscopy, laparotomy, and orthopaedic surgeries have demonstrated benefits.[72-77]

Treatment of Surgical Site Infections:

Treatment strategies are determined by various factors including the particular medical procedure executed, the nature of microbes involved, specific anatomical sites, and individual patient profiles. In instances involving the presence of foreign objects like mesh, implants, stents, or metal hardware, removal might be required due to potential contamination and biofilm formation.[78] Culturing is essential for open wounds and discharging sites, particularly if the discharge is purulent, as this will influence the choice of antibiotics. A lack of growth in wound cultures may indicate the presence of less common pathogens such as acid-fast bacteria or fungi, especially in patients with compromised immune systems. For such cases, targeted cultures for these specific organisms are recommended.

Systemic antibiotics are necessary when there are systemic indications of an infection, such as fever, pronounced skin redness, cellulitis, or signs of deeper tissue involvement. In scenarios displaying systemic infection symptoms, blood cultures are advisable. Prompt action is critical in patients diagnosed with sepsis, as timely treatment is crucial for survival. If the infection is on the surface, managing it may involve only local wound care.[79] The initial approach for treating superficial infections typically includes opening up the wound, inspecting it, draining any collections of infected fluid, and removing dead tissue. This usually takes place in an outpatient setting or at the bedside. If signs of deeper tissue involvement are evident, drainage procedures may be performed using interventional radiology or surgically in an operating room.

Following the opening of a wound, it is vital to apply dressings that maintain a clean, moist environment to promote healing while ensuring the removal of necrotic tissue and optimal temperature control.[80] Dressings should support the wound healing process by preventing tissue death due to drying out and fostering new tissue growth through self-digestion of dead tissue and the promotion of new skin formation. Dressings designed for specific types of wounds are available, with choices and changes in dressings depending on the wound's healing stage and condition. In the treatment of open, infected wounds, the use of topical antiseptics like hydrogen peroxide, diluted sodium hypochlorite, and povidone-iodine should be minimized due to their potential harmful effects on the wound healing environment.

In situations where mechanical debridement is not feasible, enzymatic agents are employed.[81]Cleaning and removal of dead tissue should continue until all non-viable material is eliminated and vibrant granulation tissue is evident. Priority is given to the removal of any infected implants or foreign materials.

Vacuum-assisted wound therapy, which uses negative pressure, helps reduce the frequency of dressing changes, prevent fluid buildup, and encourage the formation of granulation tissue. This therapy has proven effective in various surgical contexts, including after severe trauma, orthopaedic surgeries, burns, and open abdominal procedures.[82] A meta-analysis has shown a significant reduction in surgical site infections and postoperative complications, along with shorter stays in hospital settings following spinal surgeries when vacuum-assisted wound therapy is utilized.[83] Another

meta-analysis focusing on post-caesarean section women found similar benefits from employing vacuum-assisted closure (VAC) for wound management.[84]

Use of VAC dressings sometimes necessitates intermittent mechanical debridement. However, managing wounds with VAC requires careful monitoring, especially when exposed to underlying organs or major blood vessels. Deep surgical site infections, particularly in abdominal wounds, pose distinct challenges due to potential wound dehiscence risks, making exploratory procedures safer in an operating room setting. Percutaneous drainage is an option for infected fluid accumulations, often associated with anastomotic leaks after bowel surgeries. The detection of air or contrast in an intra-abdominal abscess via ultrasound or CT scans strongly indicates a bowel perforation or anastomotic leak.

Special Situations:

Management of infections linked to hernia meshes often involves several steps such as drainage, which might be performed percutaneously, administering antibiotics, debriding the wound, and possibly removing the mesh. If there is no sign of improvement after 10 to 14 days, a more forceful treatment approach might be necessary. This can include surgical exploration in the operating room and likely removal of the mesh. Although there are a few reports suggesting that treating these infections with both systemic and locally injected antibiotics can be successful, this method is not typically recommended as a standard treatment and is generally not advised.[85-87]

In cases of infections related to orthopaedic hardware, treatment strategies may comprise debridement of the bone, antibiotic therapy directly applied to the wound, long-term antibiotic use, removal of the orthopaedic implants and any cement used, irrigation of the wound, and/or surgical debridement.[88] Some patients may respond well to just debridement and antibiotics without the need to remove the hardware, however, if these treatments fail, resection arthroplasty might become necessary.[89,90] The use of antibiotic-impregnated cement or polymer-coated intramedullary nails has shown potential in initial studies.[91] When it comes to infected vascular grafts, it usually requires removing the infected segment along with replacing it using a section from an uninfected area.[92,93] Additionally, any compromised skin overlying the graft may need to be removed.[94] While partial graft excision might be considered for some patients,

meta-analyses indicate there is a high risk of the infection recurring and the potential necessity for further surgeries.[95]

The application of absorbable meshes that not only provide structural support but also release factors that aid in healing and tissue growth might be particularly beneficial for patients with compromised wound healing, such as those with diabetes.[96] Furthermore, hyperbaric oxygen therapy has been used effectively for complex, non-healing postoperative wounds, with success rates reported around 75%. For more detailed information, refer to Stat Pearls' "Hyperbaric Therapy for Wound Healing".[97]
Differential Diagnosis:

The signs of an incisional infection are typically obvious. Furthermore, the appearance of systemic symptoms soon after a surgical procedure consistently warrants an examination for potential postoperative complications, including infections, leaks, or continuous bleeding. It is crucial, however, to understand that various other conditions can manifest with similar symptoms that are not linked to the surgical wound or procedure. For example, a patient might experience cellulitis at a location not associated with the surgery, have an allergic reaction to antibiotics or other medications, or suffer from infections that are only indirectly related to the surgical intervention, such as a urinary tract infection, pneumonia, or a pulmonary embolus.

Prognosis:

Timely detection and immediate treatment of surgical wounds are vital for obtaining the best outcomes. Nevertheless, adhering rigorously to a prevention protocol is deemed the wisest strategy. Various models have been formulated in different surgical fields to help identify patients who are at high risk and to prevent surgical site infections. For example, research in colorectal cancer patients pinpointed factors such as physiological conditions, tumour characteristics, and the surgical approach as dependable predictors for surgical site infection risk.[98] Furthermore, aspects related to the surgical process like the nature of the surgery, whether it's an emergency, the classification of the wound (such as dirty or infected), the use of surgical drains, the experience of the surgeon, extended duration of surgery, and several postoperative conditions including prolonged hospital stays and the necessity for transfusions during

surgery have also been recognized as significant independent risk factors for surgical site infections.[99]

Complications:

Complications from surgical wound infections can appear both locally at the site of the wound and throughout the body. Locally, these complications can slow down the healing process of the wound, potentially leading it to become chronic and cause damage to the surrounding tissues. Additionally, these wounds can become further complicated by additional infections, the development of abscesses, and even osteomyelitis, an infection in the bone. Systemically, the complications can be more severe, including bacteraemia, which is the presence of bacteria in the bloodstream. This condition can lead to the spread of infection to distant parts of the body and result in sepsis, a life-threatening response to infection. In the most serious cases, these infections can cause organ failure or worsen other pre-existing health conditions

Postoperative and Rehabilitation Care:

Effective management of postoperative wounds is crucial during a patient's stay in a hospital or rehabilitation facility. This is particularly important as the wound itself often necessitates the patient's prolonged care. Optimal wound healing is vital for the patient's health and, in some cases, is critical to their survival. The discipline of wound care is progressively advancing, becoming more specialized and refined. Timely and thoughtful management of postoperative wounds is essential to ensure the best possible outcomes for patients.

Consultations:

The management of postoperative wound infections sometimes requires the involvement of multiple specialists. This can include experts in infectious diseases, plastic surgeons, and critical care professionals.

Deterrence and Patient Education:

Patients with identifiable and adjustable risk factors such as body mass index (BMI), control of diabetes, and smoking habits can reduce the likelihood of postoperative wound infections. Elective surgical procedures often include preoperative educational sessions and counselling to prepare patients. These preparations might involve

recommendations for patients to lose weight, follow a prescribed medication regimen, and adopt healthier lifestyles before undergoing surgery.

Ceasing smoking is another vital aspect of optimizing patient risk factors for better surgical outcomes. Where possible, it is also advantageous to involve the patient's family in these preoperative discussions. The specific recommendations and protocols may vary depending on a patient's existing health conditions and the type of surgery they are undergoing. For example, protocols for spinal surgeries might include maintaining haemoglobin A1c (HbA1c) levels below 8%, using α-blockers in males over 60 years old, ensuring that serum albumin levels are above 3.5 g/dL, performing cardiac stress tests, and highlighting the importance of quitting smoking.[100]

Antiseptic Preoperative Prep Solutions

Iodine-based sterilizing agents, such as povidone-iodine, are effective because they release free iodine. This iodine attacks and disrupts bacterial DNA along with key intracellular proteins, offering a broad range of antimicrobial effects. These solutions are widely accessible, affordable, and considered safe for use on various skin types, including sensitive areas. Specifically, they are useful for preparing transvaginal and transurethral sites due to their safety on mucosal surfaces. However, it is vital to avoid their use in individuals allergic to iodine. Typically, the application process involves an initial scrubbing followed by a painting of the iodine solution onto the skin.

Alcohol-based antiseptic solutions are appreciated for their extensive antimicrobial capabilities. They are cost-effective, act quickly, and a single application is usually enough as they dry swiftly. When compared to iodine-based solutions, alcohol-based antiseptics are simpler to apply, have a more prolonged antimicrobial effect, require less drying time, and provide superior efficacy. However, their high flammability requires ensuring the skin is completely dry before proceeding. Moreover, alcohol should not be used on mucous membranes due to its irritating properties.[12]

Chlorhexidine gluconate, commonly used in its aqueous form, works by destroying bacterial cell membranes and offers a longer-lasting antiseptic action than iodine-based antiseptics, with greater resistance to neutralization. It is widely utilized for preoperative cleansing, including patient showers and surgeon hand scrubs, and as a general skin preparation agent. A significant study involving around 7,000 patients

assessed chlorhexidine in comparison to iodine-based solutions for skin preparation, finding no notable difference in rates of surgical site infections.[101]

Solutions combining alcohol with iodine or chlorhexidine take advantage of both agents, generally resulting in extended-duration antisepsis compared to when these agents are used separately. This combination is thought to provide enhanced effectiveness due to the different mechanisms of antimicrobial action.[102]

In surgical prophylaxis, selecting a safe, effective agent that specifically targets the expected pathogens is crucial. Antibiotics should be administered within 30 to 60 minutes before surgery to ensure adequate levels are present at the start. For clean procedures, the antibiotics chosen should primarily target skin flora like staphylococci. In clean-contaminated procedures, the coverage should also include organisms like gram-negative rods and enterococci, with typical choices being cefazolin, vancomycin combined with metronidazole, cefoxitin, or ertapenem. For contaminated and dirty procedures, antibiotic treatment should continue based on the initial regimen or may be adjusted intraoperatively based on surgical findings.

Enhancing Healthcare Team Outcomes:

In the period surrounding surgery, a wide range of healthcare professionals, both directly and indirectly involved, play a pivotal role in reducing the likelihood of postoperative wound infections. Before surgery, it's crucial to identify and address any changeable risk factors, and to educate the patient about potential risks. This education is often facilitated by the collaborative efforts of nurses, anaesthesiologists, and surgeons, but it's important for all members of the healthcare team to participate in educating and reinforcing preventive strategies to the patient.

Maintaining a clean environment in the operating room is critical, especially near the operating table. Various items, including anaesthesia equipment, personal belongings of the staff such as pens and cell phones, and other medical devices like suction machines, blood pressure cuffs, and x-ray machines, should be treated as potentially contaminated and cleaned on a regular basis. During the operation, it is imperative for all operating room staff to adhere strictly to sterile procedures to ensure a clean surgical environment. After the surgery, the role of healthcare professionals in influencing both

the recovery process and the likelihood of postoperative wound infection continues to be significant.[103]

Patel et al. (2012)[104] focused on the incidence and risk factors for SSIs at a tertiary care hospital in Gujarat, India. The study included 200 patients, finding an overall SSI rate of 16%, predominantly caused by E. coli (35.7% of positive cultures). The authors highlighted that extended preoperative hospital stays, higher ASA scores, emergency surgeries, and longer surgical durations were associated with increased SSI rates. The study underscored the importance of using risk indices, such as the NNIS risk index, to identify potential risk factors for SSIs and to facilitate effective monitoring and intervention strategies.

Chalumeaux et al., (2015)[105] reviewed measures for preventing surgical site infections beyond antibiotic prophylaxis. The study highlighted the role of airborne contaminants in intra-operative contamination, emphasizing the importance of maintaining a clean environment through advanced ventilation systems and stringent surgical protocols. It concluded that while various measures exist to prevent SSIs, the critical aspect lies in the surgeon's technique and operating room discipline.

Zejnullahu et al. (2019),[106] concluded that the risk factors for SSIs post-caesarean section included patient demographics and surgical procedures, which must be integrated into infection control strategies. The authors stressed the importance of continuous monitoring and adaptation of practices to mitigate the risks associated with SSIs, advocating for updated guidelines to address nosocomial infections effectively.

Kochhal et al. (2020)[107] undertook a study to investigate the clinico-microbiological profile of SSI in a tertiary care hospital. They evaluated a cohort of 100 patients who underwent clean and clean-contaminated surgeries across various departments. The overall infection rate was reported at 6%, with the highest incidence observed in patients aged over 71 years (14.28%). The study indicated that Escherichia coli and Klebsiella pneumonia were the most common pathogens responsible for SSI. However, none of the assessed risk factors showed a significant association with the development of SSI. The authors concluded that the study provides valuable insights into the

microbial pathogens prevalent in their institution, paving the way for future research on the epidemiology and treatment of SSIs.

Mez emir et al. (2020)[108] conducted a study at an academic trauma and burn centre in Ethiopia with the objectives of determining the prevalence and root causes of surgical site infections (SSI) among patients undergoing major surgery. They concluded that the prevalence of SSI was 24.6%, with orthopaedic and abdominal surgeries having the highest rates. Factors such as educational status, pre-existing conditions, and the duration of hospital stays were identified as significant predictors of SSI, emphasizing the need for focused preoperative care and monitoring.

Gillespie et al. (2021)[109] carried out a systematic review and meta-analysis to estimate the worldwide incidence of SSI among general surgical patients, incorporating data from 488,594 patients across 62 studies. They found a pooled 30-day cumulative incidence of SSI of 11%, with variations based on anatomical location and the urgency of surgery. This comprehensive analysis underscores the global burden of SSI and the critical need for enhanced preventive measures in surgical settings.

Dégbey et al. (2021)[110] studied the prevalence and factors associated with SSI in a university hospital in Cotonou, Benin. Their retrospective analysis revealed an SSI prevalence of 7.81%, with patient admission method and length of postoperative stay being significant risk factors. They emphasized the importance of addressing healthcare system inefficiencies and errors to mitigate the occurrence of SSIs, advocating for better patient monitoring and resource allocation.

Jain et al. (2022)[111] conducted a study to assess the prevalence, risk factors, and microbial profile of surgical site infections (SSI) after caesarean sections in a tertiary care centre in Western India. The research revealed that SSI was the predominant complication following caesarean deliveries, with a prevalence rate of 14.7%. The study identified significant risk factors associated with SSI, including emergency caesarean delivery, severe anaemia, lack of preoperative antibiotic use, high Body Mass Index (BMI), pre-existing chronic diseases, and a history of previous caesarean sections. The microbial analysis indicated that *Klebsiella pneumoniae* and *Staphylococcus aureus* were the most prevalent isolates. Furthermore, the study

highlighted that Imipenem demonstrated the highest susceptibility, whereas Amoxicillin-Clavulanate exhibited significant resistance. The findings emphasize the necessity for prompt identification of risk factors and microbial agents to guide appropriate antimicrobial therapy and infection control measures.

Birhanu et al. (2022)[112] conducted a study to determine the magnitude and determinants of surgical site infections (SSIs) among postoperative patients at Dilla University Referral Hospital. Their findings revealed that the prevalence of SSIs was high, recorded at 19.3%. Key factors significantly associated with the occurrence of SSIs included low haemoglobin levels (AOR = 10.40), shock (AOR = 19.09), previous surgeries (AOR = 11.53), and prolonged hospital stays (AOR = 5.51 for 7-14 days and AOR = 8.18 for more than 14 days). The study concluded that interventions targeting these risk factors could potentially reduce the incidence of SSIs in surgical settings.
Mohan et al. (2023)[113] performed a study in Trichy, Tamil Nadu, India, aiming to assess the prevalence and risk factors of SSI among surgical patients in a tertiary care centre. They found a lower prevalence of 5.6%, primarily associated with abdominal surgeries. The study identified that younger patients, males, those undergoing emergency procedures, and patients with diabetes were at a heightened risk for developing SSI. This highlights the need for targeted preventive strategies in these high-risk groups.

Habte weld et al. (2023)[114] conducted a prospective cross-sectional study in Northeast Ethiopia to evaluate the prescribing patterns of surgical antimicrobial prophylaxis and its determinants among hospitalized patients. The study found that a significant portion (78%) of patients were exposed to inappropriate prophylactic antimicrobials, with 61.9% developing SSIs. Key independent predictors for SSI included procedures lasting longer than an hour and the inappropriate use of antimicrobial prophylaxis, with patients receiving inappropriate prophylaxis being 6.67 times more likely to develop SSI. The authors called for increased awareness and stringent guidelines on antimicrobial prophylaxis to mitigate the high rates of SSI observed.

Andrewes et al. (2023)[115] aimed to estimate the prevalence rate of SSIs and identify common pathogens among colorectal cancer (CRC) patients undergoing bowel resection surgery at King Abdulaziz Medical City. The study found that 27.2% of the 92 patients developed SSIs, with Escherichia coli and Pseudomonas aeruginosa being

the most frequently isolated pathogens. Additionally, low preoperative serum albumin levels emerged as a significant independent risk factor (AOR = 0.853). The authors concluded that close monitoring and management of serum albumin levels prior to surgery could reduce SSI occurrences in this patient population.

Odada et al. (2024)[116] conducted a retrospective case-control study at a tertiary hospital in Kenya to investigate the risk factors associated with SSIs following caesarean sections. Of the 1,262 caesarean deliveries analysed, 2.1% developed SSIs. However, the study found no statistically significant associations between the identified risk factors (such as gestational age, body mass index, and antibiotic prophylaxis) and the development of SSIs. The authors suggested that further prospective studies should be conducted to more accurately assess the influence of these risk factors on SSI development.

Montoya et al. (2024)[117] focused on preventive strategies in paediatric cardiovascular surgery and their impact on surgical site infections. Their cohort study analysed data from 2512 surgeries performed between 2010 and 2021. The overall incidence of SSI was found to be 5.9%, alongside other healthcare-associated infections (HAIs) such as central line-associated bloodstream infections (CLABSI) and catheter-associated urinary tract infections (CAUTI). The study documented a significant reduction in SSI from 9.5% in 2010 to 3.0% in 2021 due to the implementation of various preventive interventions, including targeted antibiotic prophylaxis and vacuum-assisted closure in clean wounds. The authors concluded that while the preventive strategies effectively reduced the incidence of SSI, there was no significant impact observed on other types of HAIs.

Patel et al. (2024)[118] investigated the bacteriological profile and antimicrobial susceptibility patterns of pathogens causing SSIs at a tertiary care hospital in Western Gujarat. Out of 250 patient samples, 40.8% showed positive cultures, with Klebsiella pneumoniae being the most prevalent isolate (23.53%). The study revealed that the majority of Gram-negative isolates were sensitive to carbapenems, while Gram-positive isolates exhibited sensitivity to linezolid and levofloxacin. The authors concluded that periodic analysis of SSI pathogens and their susceptibility patterns is crucial for addressing the burden of SSIs effectively.

Wondmeneh et al. (2024)[119] conducted a systematic review and meta-analysis on the incidence of SSI among women undergoing caesarean sections in Ethiopia. They found a pooled incidence of 12.32%, identifying several independent risk factors, including rural residency, membrane rupture, and anaemia. Their findings indicate that special attention should be given to women in rural areas and those with specific medical conditions, reinforcing the importance of tailored preoperative assessments and interventions.

Savio et al. (2024)[120] investigated the epidemiology and risk factors of surgical site infections in severe trauma patients in intensive care, aiming to shed light on this often overlooked complication. They concluded that a high rate of SSIs (23%) was found among severe trauma patients, with factors such as low haemoglobin levels, hyperlactatemia, and specific injury classifications being linked to increased infection risk. Despite the prevalence of SSIs, they noted that these infections did not correlate with increased mortality over 48 months.

Bucataru et al. (2024)[121] conducted a study with the objective of exploring the factors contributing to surgical site infections (SSIs) through a comprehensive systematic review of aetiology and risk factors. They concluded that surgical site infections remain a significant concern in hospital-acquired infections, exacerbated by antibiotic resistance, increased surgical procedures, and patient comorbidities. Their review emphasizes the need for a thorough understanding of the multifaceted factors associated with SSIs to enhance patient safety and surgical care quality.

MATERIAL AND METHODS

- Study design: Prospective cross-sectional study
- Study area: Department of Microbiology at Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh, India.
- Study period: Research study was conducted from Aug 2023 to July 2024.
- Below is the work plan.

Table 1: Work plan of the study with percentage of allocation of study time and duration in months

Work plan	% of allocation of study time	Duration in months
Understanding the problem, preparation of questionnaire.	5-10%	July 2023 to Aug 2023
Pilot study, Validation of questionnaire, data collection and manipulation	Up to 80%	August 2023 to September 2024
Analysis and interpretation	5-10%	October 2024 to December 2024
Dissertation write-up and submission	5-10%	January 2025 to March 2025

- Sample size: Min sample size was 225, but all patients who underwent various surgical procedures were taken in the study , cases fulfilling clinical criteria of Surgical site Infections NHSN 2023 guidelines were included in the study. This sample size was determined based on the expected prevalence of surgical site infections in the hospital population, with a confidence level of 95% and an acceptable margin of error of 5%. Of the total samples processed, 160 (71.1%) yielded positive culture results, while 65 (28.9%) showed no microbial growth.

- **Inclusion criteria:**
    1. Patients of all ages who underwent surgical procedures at Santosh Medical College and Hospital during the study period.
    2. Patients of both genders.

3. All post-operative patients in all the departments of our hospital.
4. Both rural and urban residents.
5. Patients from all occupations and socio-economic backgrounds.
6. Patients with or without history of smoking and alcohol consumption.
7. Patients with co-morbidities including but not limited to: Hypertension, Diabetes Mellitus, Chronic Obstructive Pulmonary Disease (COPD), Coronary Artery Disease (CAD), Chronic Renal Failure (CRF), and any other documented medical conditions

- **Exclusion criteria:**
  1. Samples not meeting the established CDC criteria for Surgical Site Infections (SSIs)
  2. Incorrectly labelled or identified samples.
  3. Samples not collected or transported in appropriate sterile containers.
  4. Leaked samples with compromised integrity.
  5. Patients who did not give consent to participate in the study.
  6. Patients whose follow-up was inadequate to determine the presence or absence of SSI.

METHODOLOGY:

A prospective cross-sectional study was conducted in the Department of Microbiology at Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh. The study aimed to investigate the rate, microbiological profile, and risk factors of surgical site infections (SSIs), while evaluating the impact of various prevention strategies. A total of 225 patients who have undergone various surgical procedures in all the departments of our hospital and were clinically suspected to have developed Surgical site infections were included in the study. Patient consent for the study was taken.

Sample Collection and Processing

2 Swab samples/pus samples were collected from post-operative patients from all departments of our hospital, showing clinical symptoms of surgical site infections. Collection was performed under strict aseptic conditions, and samples were transported to the microbiology laboratory as soon as possible. For patients with SSIs, the wounds were first graded according to standard CDC classification (superficial incisional, deep incisional, or organ/space SSI).

Laboratory Procedures

All samples were processed in the microbiology laboratory using the VITEK 2 automated system[122] for organism identification and antimicrobial susceptibility testing. Initially, each sample was subjected to Macroscopic and Microscopic examination, which includes Gram staining to categorize the organisms as Gram-positive or Gram-negative. Direct microscopic examination was performed to observe cellular morphology, arrangement, and presence of inflammatory cells.

The samples were cultured on 5% Sheep Blood Agar and MacConkey agar media and incubated at 37°c for 24-48 Hours. The plates were examined for growth characteristics, colony morphology, and haemolysis Patterns on blood agar. Isolates from positive cultures and were Examined by performing gram staining and biochemical tests and categorised as gram positive cocci and gram negative
Bacilli.

1. Macroscopic Examination of Sample

1. Colour
2. Odour
3. Consistency

2. Microscopic Examination of Sample

GRAM STAINING [2]

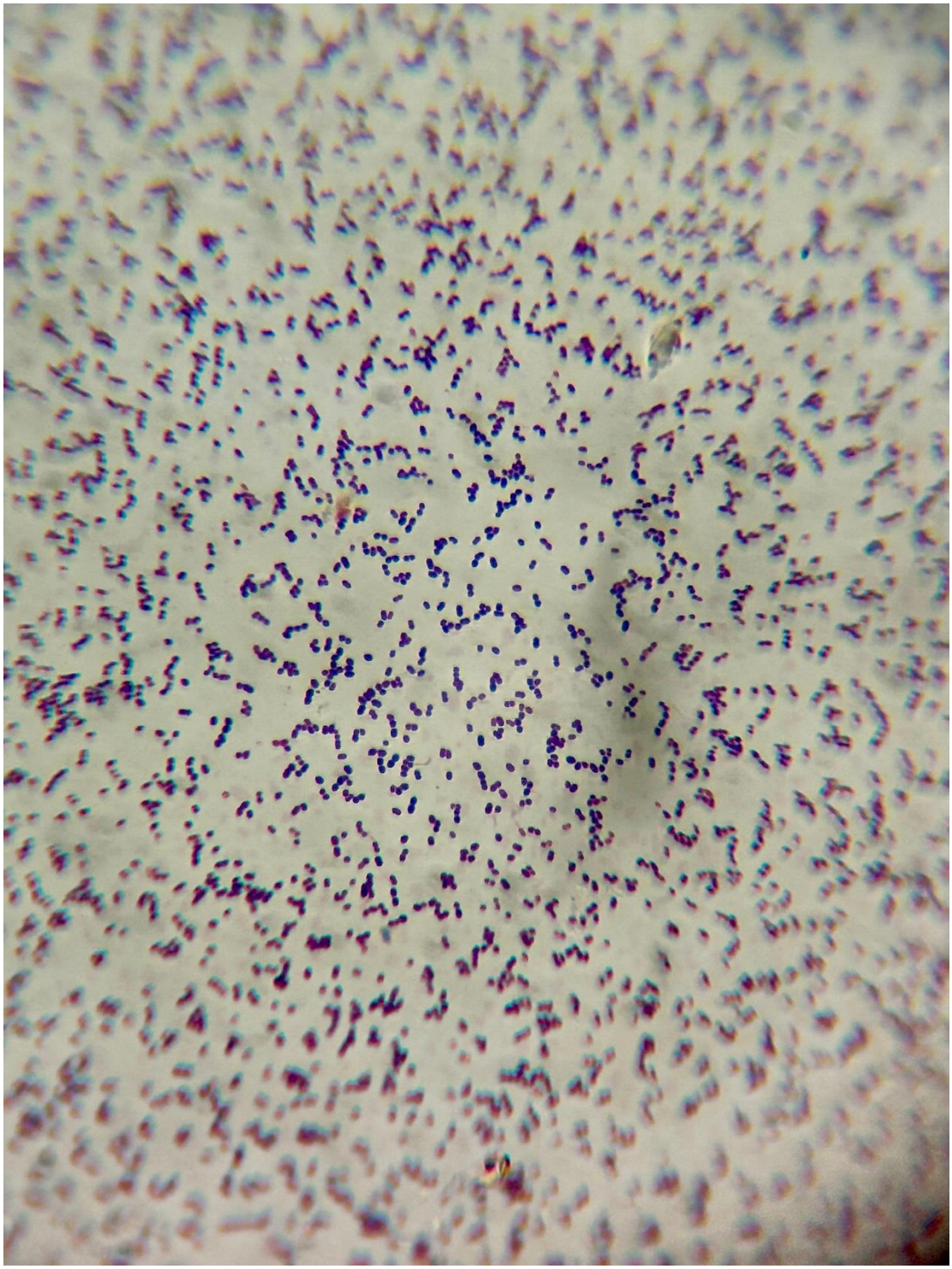
Principle

Gram staining differentiates bacteria by the chemical and physical properties of their cell walls by detecting peptidoglycan which is a thick layer in the cell wall of Gram positive bacteria. A gram positive bacteria appears purple in colour and a gram negative in pink colour.

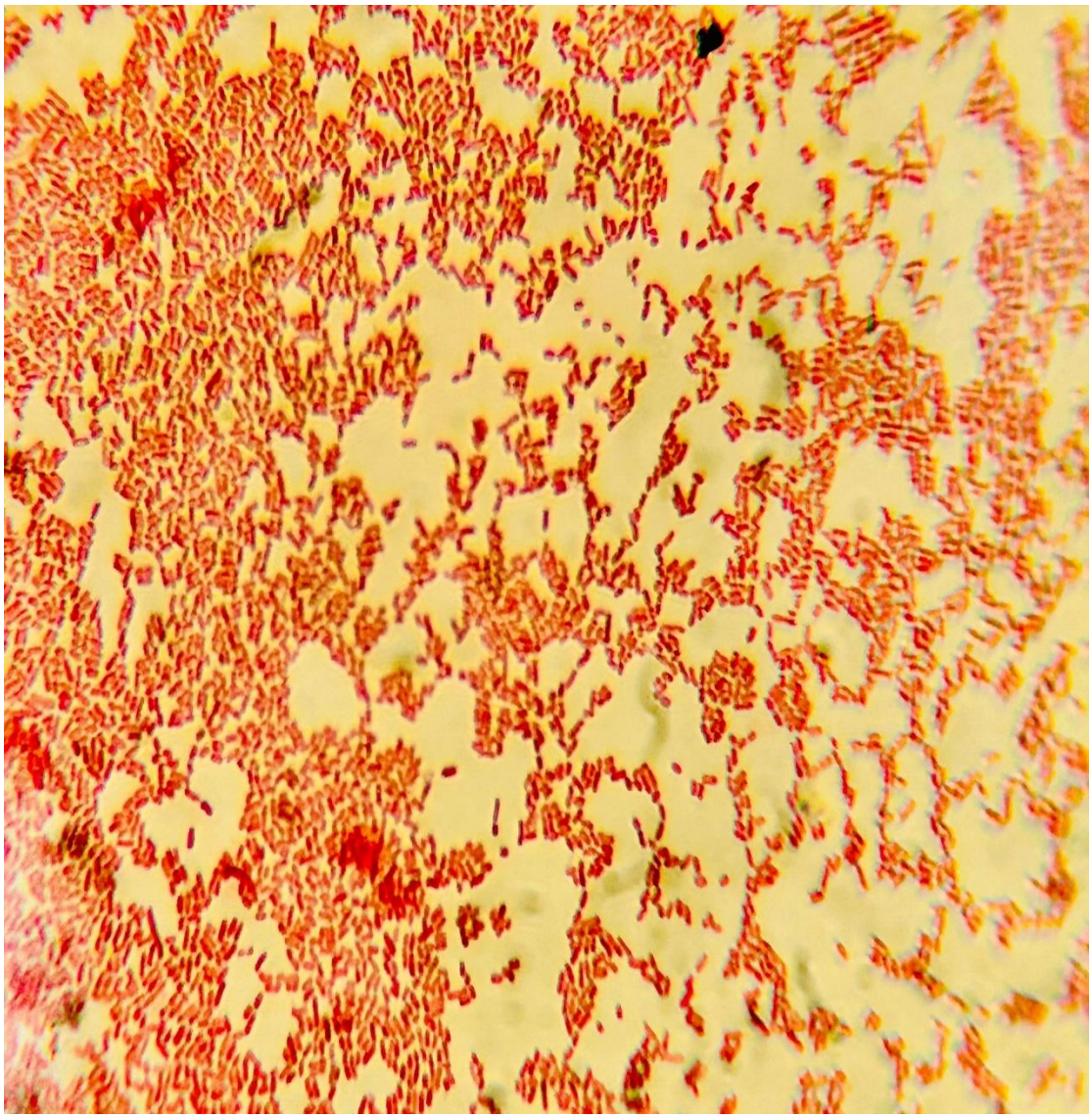
Procedure

- Pus sample was taken with a sterile inoculating wire loop on a clean glass slide and with swab on the slide and a thin smear was made and allowed to dry.

- Smear was fixed by passing the slide 4-5 times through the flames of Bunsen burner.
- Slide was placed on the staining rack , smear was stained with primary stain crystal violet stain for 1 minute, and washed with tap-water.
- Gram's Iodine solution was applied over the smear for 1 minute.
- Smear was decolourised with Acetone for 2-3 seconds.
- Slide was washed with tap-water and stained with counter stain safranin for 30 seconds.
- Slide was washed with tap water, dried and observed under low power objective (10X) and then oil immersion objective (100X) of the microscope.
- Gram reaction was observed as Gram positive and Gram negative
- Morphology – Cocci/ Bacilli/ Coco Bacilli, arranged in clusters/chains/pairs or singly were observed.



Gram stain showing Gram positive Cocci



Gram stain showing Gram Negative Cocci

3.CULTURE [2]

- Pus culture was done on Blood Agar/ Mac Conkey Agar.
- Culture plates were incubated at 37^0C and observed for 24 – 48 hrs.

Ingredients of Blood Agar

- Sterile Nutrient Agar with 5% sheep blood

Ingredients of Nutrient Agar

- Peptone 10g
- Sodium Chloride (NaCl) 5g
- Beef Extract/ox heart/meat 500g
- Agar 2-3%
- Distilled Water 1 litre
- pH Adjusted to Neutral 7.4 – 7.5 at 25^0C

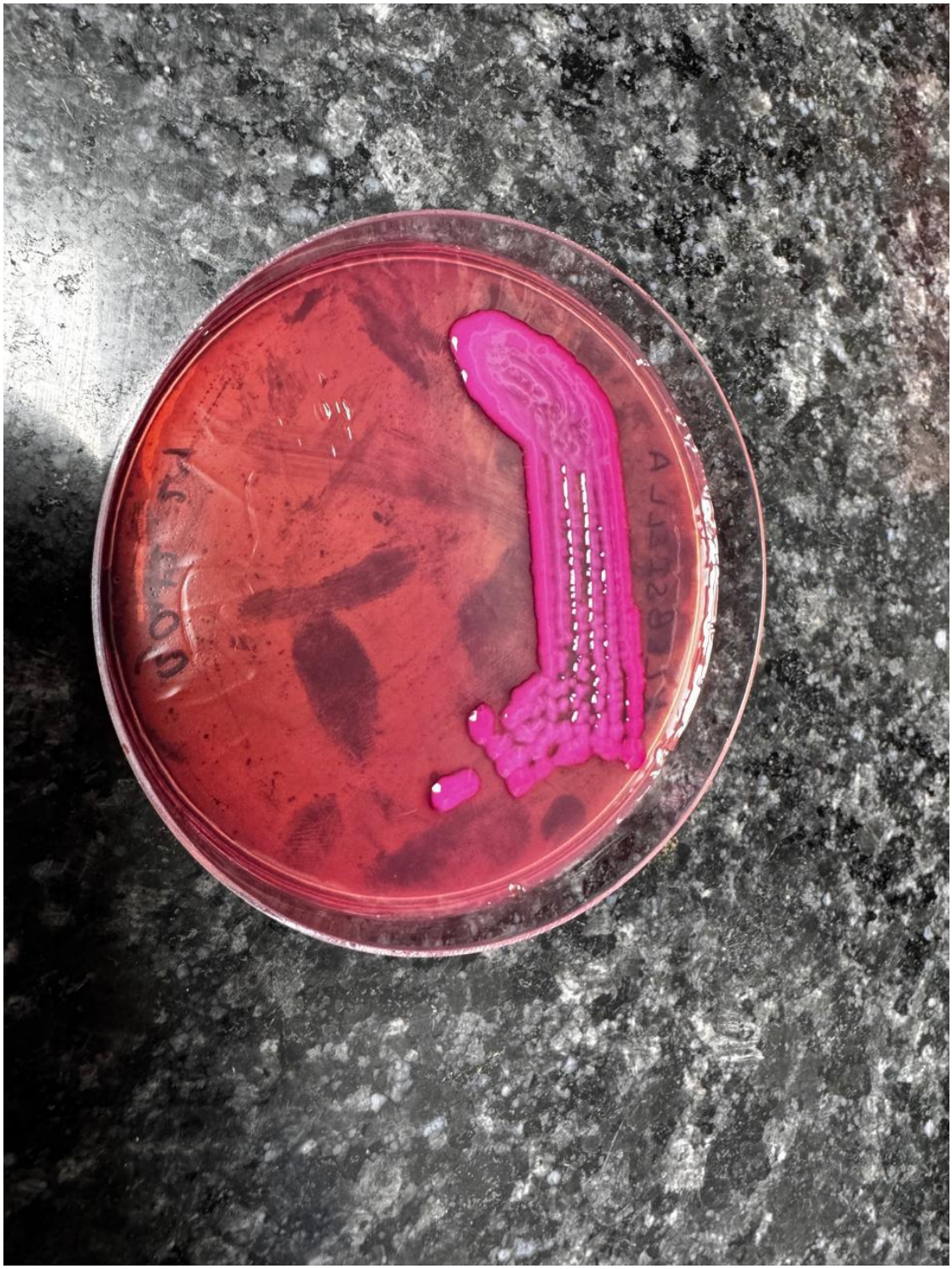
Ingredients of MacConkey Agar

- Peptone 20 g
- Sodium Taurocholate 5 g
- Water 1 litre
- Agar 20 g
- Neutral Red Solution 3.5 ml
- Lactose 100 ml

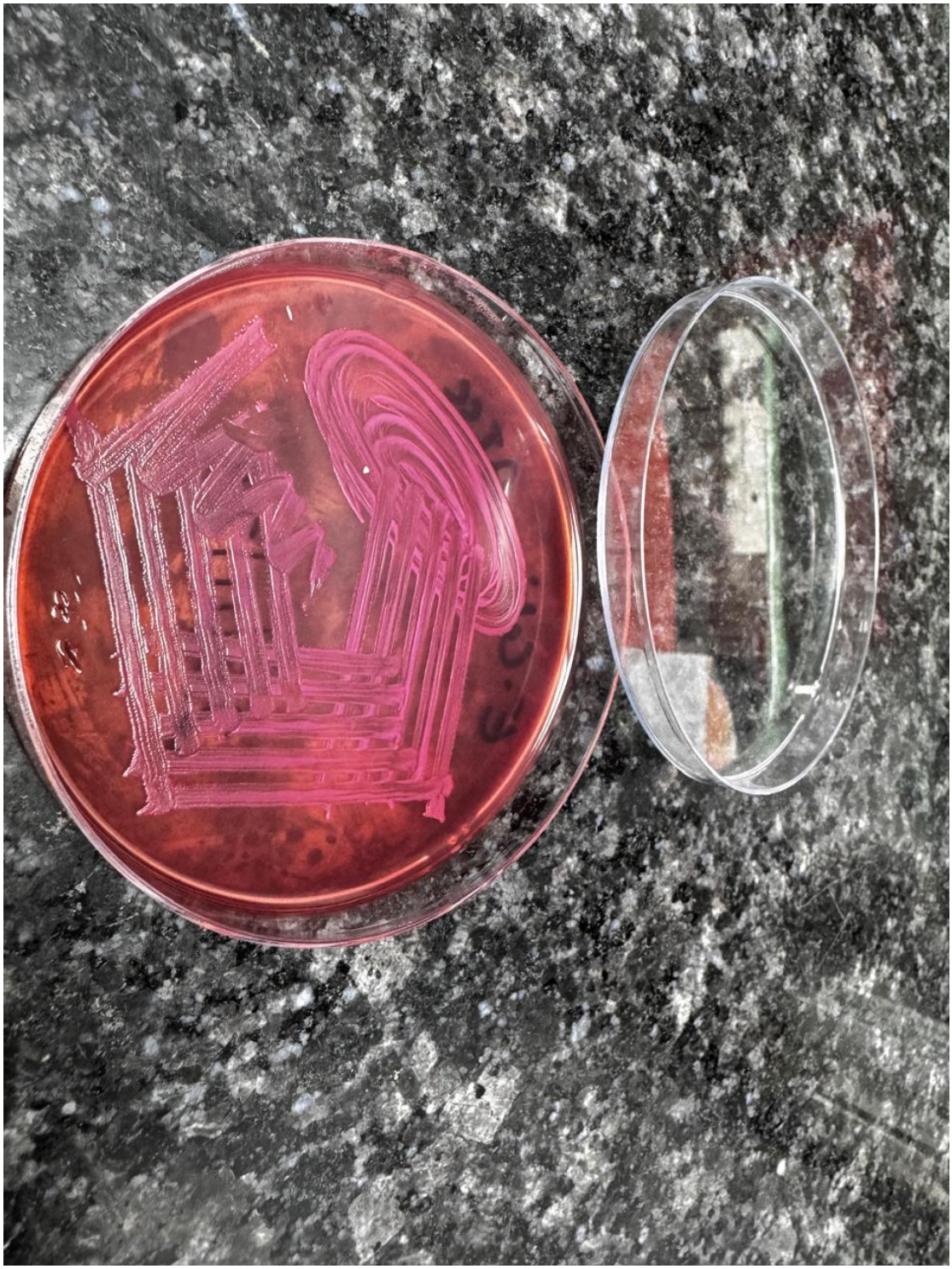
4.Identification of Bacteria

- Identification of bacterial isolates was done observing the microscopic appearance, colony morphology, colony characteristics as size, form, elevation, margin, colour, surface, density, odour, and pattern of haemolysis on blood agar along with any pigment production in the culture media.

Blood Agar showing colonies of Staphylococcus Aureus



Mac Conkey Agar showing colonies of Klebsiella pneumoniae



Mac Conkey Agar showing colonies of Escherichia Coli

5. **Motility**

- Performed by Hanging Drop method.

Principle

- This test is carried out to check if an Organism is motile or non motile. Bacteria possess Flagella to be motile.

Procedure

- A slide with concavity was taken and encircled with a streak of soft petroleum jelly with a glass rod to the surface of the slide.
- A drop of liquid culture containing the colony inoculated was placed on the surface of cover slip and then was inverted over the concavity of slide.
- The drop now can be seen hanging within the centre concavity of the slide.
- The slide was examined under the microscope with a low power (10x) and then with a high power (40x) objective of the lens.

Organisms were observed for motility by changing positions with respect to each other often moving across the field or showing some Brownian movement in which the organisms may appear active but they remain in the same relative position to other organisms in the field.

Biochemical tests

For identification of the bacterial isolates as Gram positive and Gram positive further cytochrome oxidase test to process with GP& GN cards of the VITEK 2 automated system

Catalase test [2]

Principle

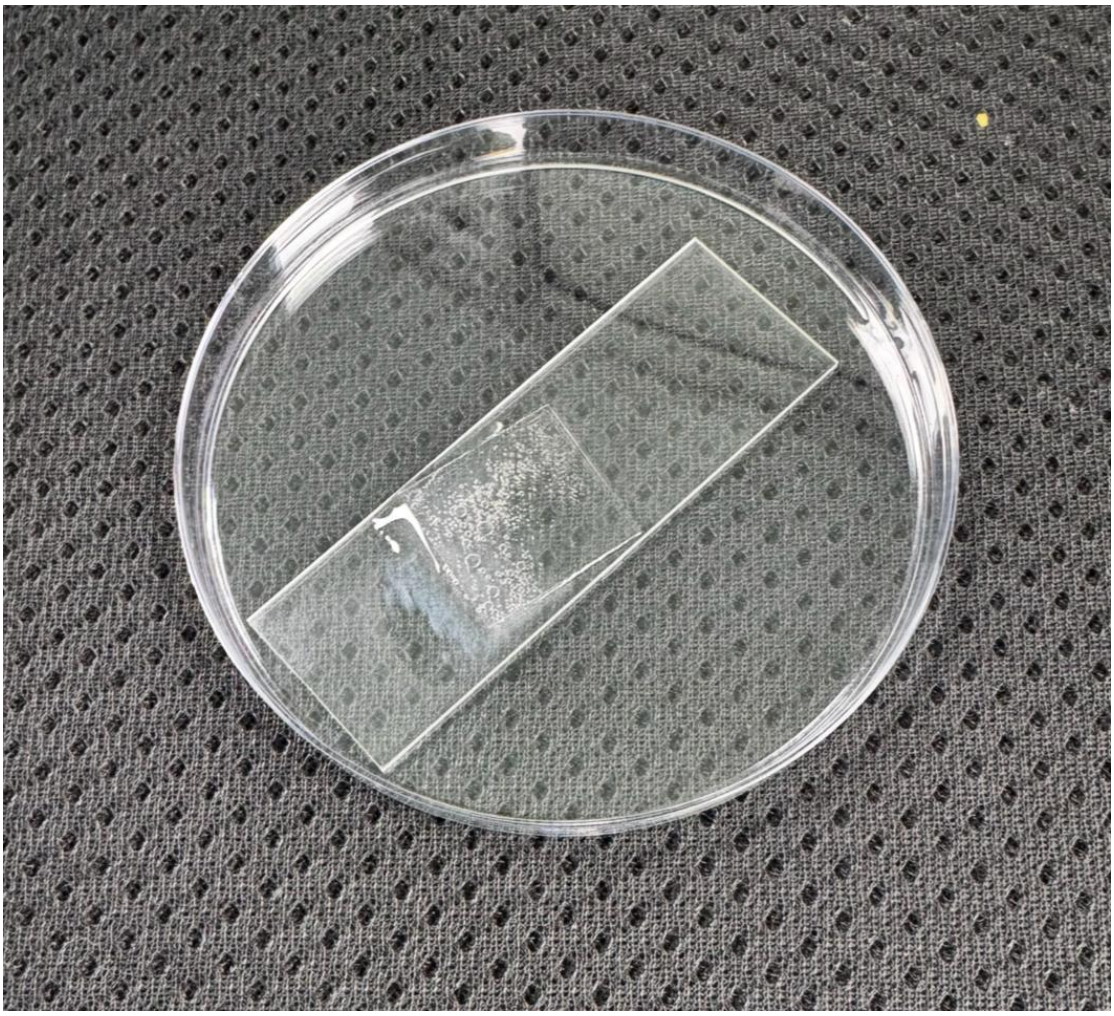
Catalase is an enzyme that decomposes Hydrogen Peroxide ($H_2O_{2)}$ into water and Oxygen.

Reagents

3% H_2O_2 stored in a brown bottle under refrigerator and an 18-24 hrs culture of the bacterial isolate to be tested.

Procedure

- With an inoculating wire, growth from culture was transferred from the colony to the surface of clean glass slide.
- One drop of 3% Hydrogen Peroxide (H_2O_2) and was observed for bubbles formation.
- Rapid appearance of effervescence indicated it as a positive test.



Effervescence showing Positive Catalase Test

Oxidase test [2]

Principle

This test helps identifying the bacteria possessing the enzyme cytochrome oxidase with the help of substrate Tetramethyl-p-Phenylenediamine Di hydrochloride to Indophenol, a dark Purple
-coloured end product.

Procedure (Wet Filter Method)

- A strip of filter paper soaked with a little freshly prepared 1% of solution of the reagent was used by rubbing a speck of culture on it with a platinum wire loop.
- Development of a dark purple colour within 10 seconds was read as oxidase positive which helped in processing for GNB isolates.

Quality Control

Positive- *Neisseria gonorrhoeae*
Negative- *Escherichia coli*

Slide coagulase test [2]

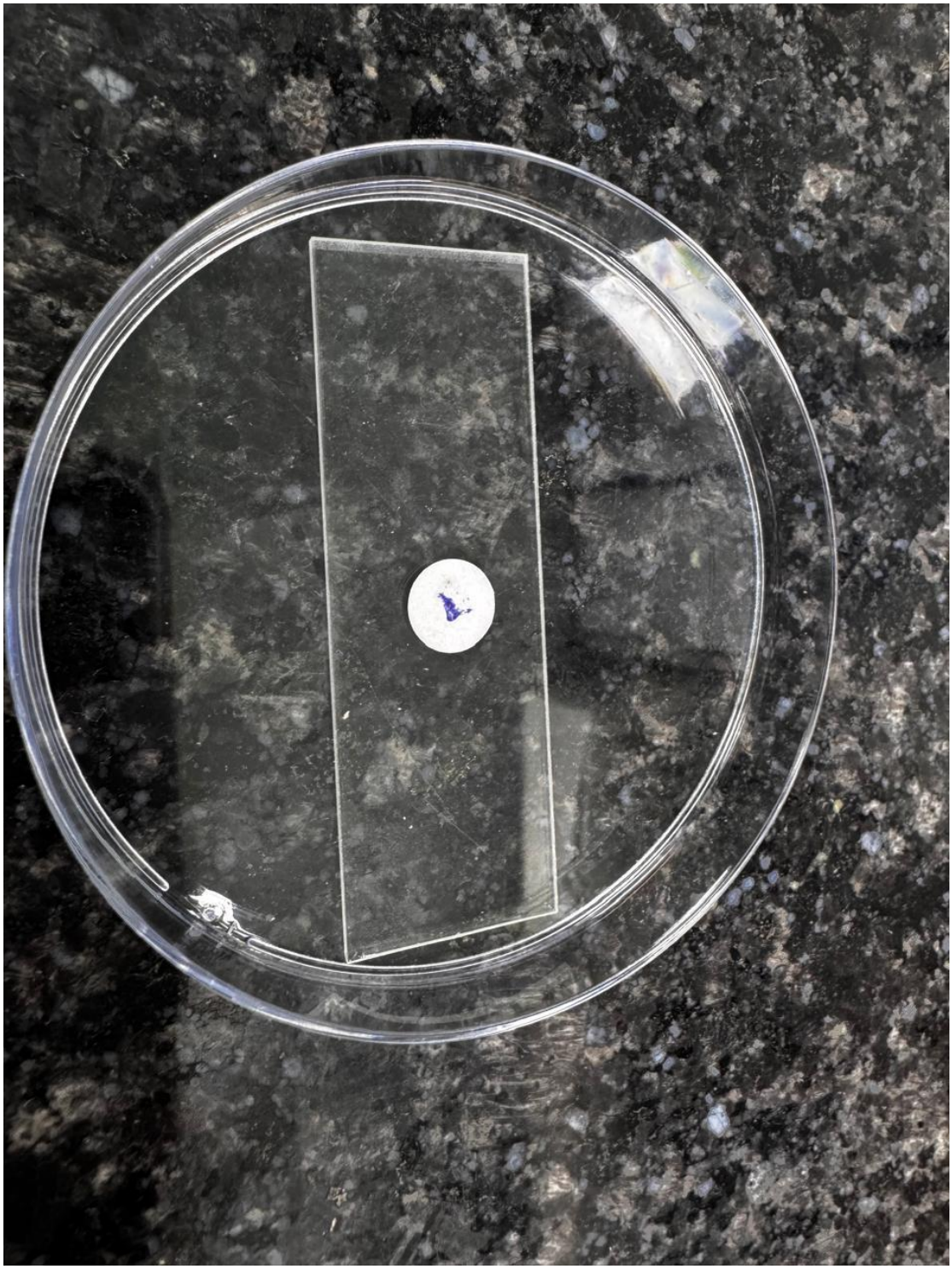
Principle

- This test detects clumping factor present in *Staphylococcus Aureus* and absent from most other *Staphylococcus Spp.* The reagent is either human plasma or rabbit plasma.

Procedure

- A colony of *Staphylococcus* was emulsified in a drop of normal saline on clean glass slide till a milky suspension was formed.
- Similar suspensions of control positive and negative strains were made to confirm the proper reactivity of the plasma.
- The inoculating loop was dipped in the undiluted plasma at room temperature, and it was mixed into the *Staphylococcus* suspension on the slide.

- A visible coarse clumping of cocci to the naked eye shown the test as positive within 10 seconds, negative was taken if no clumping was seen or seen more than 10 seconds.



Positive Oxidase test

Tube coagulase test [2]

Principle

This test for *staphylococcus Aureus* can be performed with Rabbit plasma or human plasma, Rabbit plasma is preferable as it gives better clotting and is free from inhibitors and is safe. It also detects the clumping factor and is a definitive test for *Staphylococcus Aureus.*

Procedure

- 1-6 dilution of the plasma in saline (0.86% NaCl) were prepared and placed in 1 ml volume of the diluted plasma in small tubes.

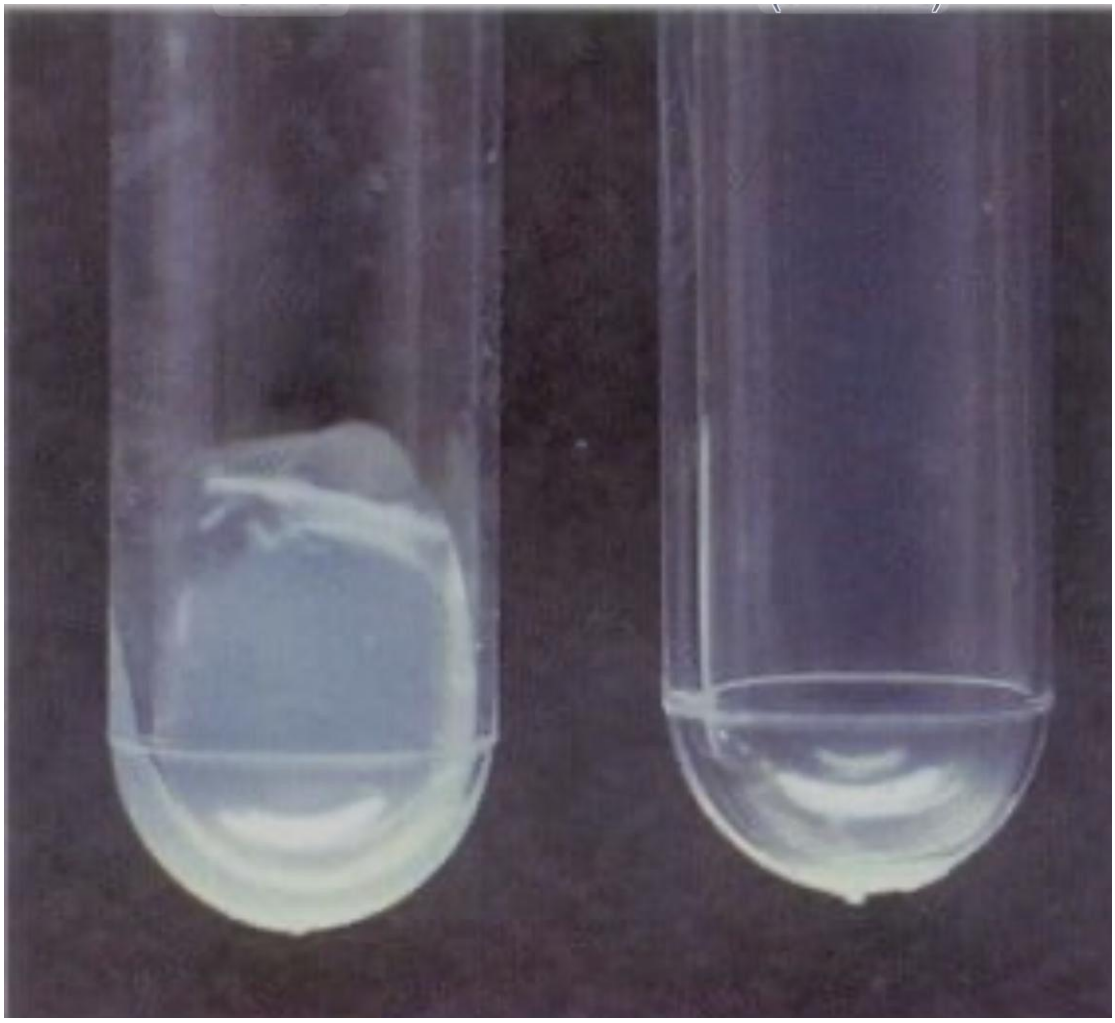
- A colony of *Staphylococcus Aureus* under test was emulsified in a tube of the diluted plasma.

- Each batch of tests tubes included known Coagulase-positive and coagulase-Negative cultures as controls and a tube of unseeded diluted plasma to confirm that it doesn't coagulate clot simultaneously.

- The tubes were incubated for 4 hours at 37^0C.

- The tubes were examined for 1,2, 4hrs for the formation of clot formation.

- The formation of a stiff gel that remained in place even after tilting the tubes or inverted read as positive tests, and in which plasma remained wholly liquid or ropy precipitate were taken as negative.

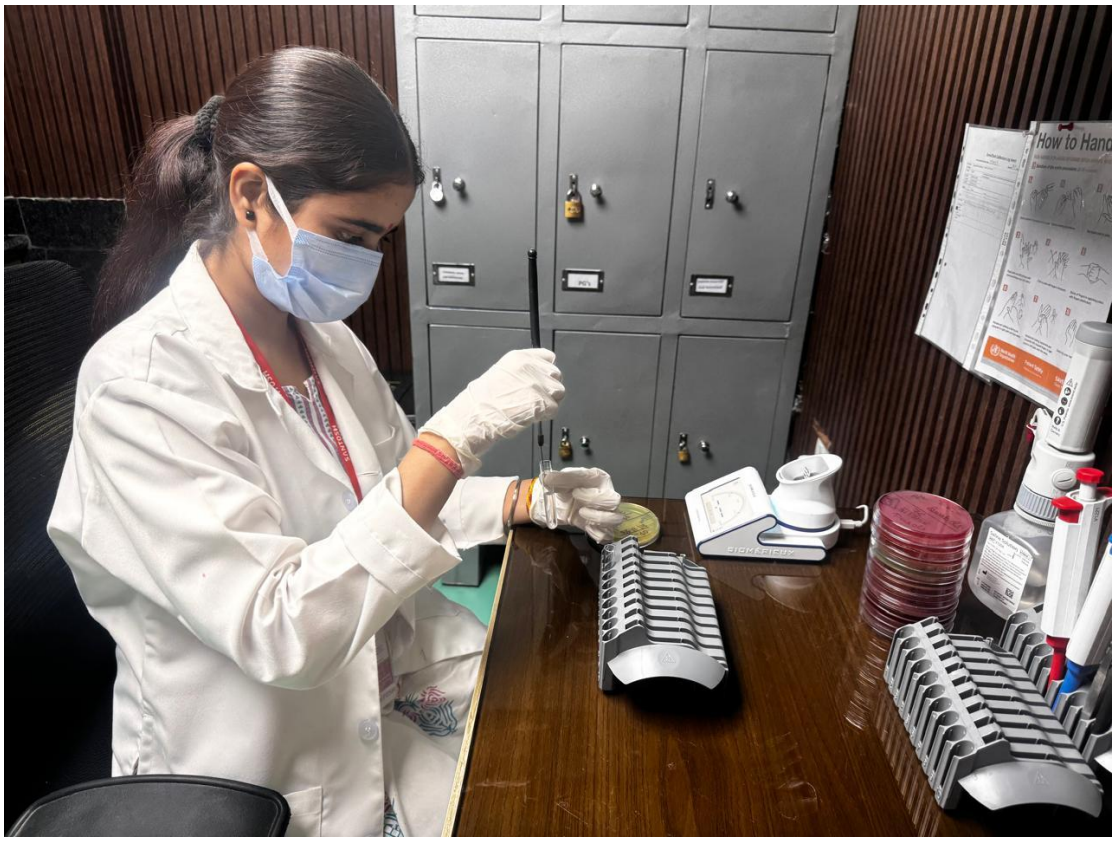


Positive Tube Coagulase test

INOCULUM PREPARATION

Suspensions were prepared by emulsifying bacterial isolates in 0.45% saline to the equivalent of a 0.5 McFarland turbidity standard. The same suspension was used for identification and AST for the VITEK 2 system[122]. Suspensions for the comparative identification method were made according to the manufacturer's recommendations.

They were processed further using the VITEK automated system [123] with GP cards for Gram-positive organisms and GN cards for Gram-negative organisms. This system provided rapid and accurate identification of microorganisms and their antimicrobial susceptibility patterns.



Innoculum preparation for the VITEK 2 Automated system for Identification and AST

Processing of samples with VITEK 2 Automated System

Out of the 225 samples processed, 160 samples (71.1%) showed positive culture results, while 65 samples (28.9%) showed no growth. The antimicrobial susceptibility testing was conducted according to Clinical and Laboratory Standards Institute (CLSI) 2023 guidelines to determine the resistance patterns of the isolated organisms.

Risk Factor Assessment

Detailed patient information was collected through a structured proforma. This included demographic data, relevant medical history, surgical details (type of surgery, duration, and emergency/elective nature), preoperative hospital stay, antibiotic prophylaxis administration, and presence of any implants. Information regarding co-morbidities, nutritional status, and habits like smoking and alcohol consumption was also documented.

Evaluation of Prevention Strategies

The implementation and effectiveness of various SSI prevention strategies were assessed through a comprehensive approach. This included evaluation of preoperative measures such as, appropriate skin preparation, antibiotic prophylaxis timing, and intraoperative factors like maintenance of asepsis, double-gloving practices, glycaemic control, and normothermia maintenance. Postoperative care practices and wound management techniques were also documented and analysed.

Data Analysis

All collected data was entered into a Microsoft Excel spreadsheet and analysed using SPSS statistical software. Descriptive statistics were calculated for categorical variables as percentages and for continuous variables as means with standard deviations. Chi-square tests and other appropriate parametric and non-parametric tests were utilized to establish associations between risk factors and SSI occurrence. A p-value of less than 0.05 was considered statistically significant for all analysis.

The SSI rate was calculated as the by the cases fulfilling the criteria as per NHSN 2023, culture positive cases divided by total number of surgical procedures done within the defined time frame. The microbiological profile of the causative organisms

and their antibiotic resistance patterns were analysed to identify predominant pathogens and guide empirical antibiotic therapy.

Image showing a Case of Deep Incisional SSI in a Exploratory laparotomy

RESULTS

This is a prospective cross-sectional study in the department of Microbiology, Santosh Medical College and Hospital, Ghaziabad, UP, to study the rate, microbiological profile and risk factors of surgical site infections, evaluating impact of prevention strategies.

Table 1: Distribution of patients according to age

Age (in years)	Frequency	Percentage
<20	18	8%
20-40	112	49.8%
41-60	65	28.9%
61-80	29	12.9%
>80	1	0.4%
Total	**225**	**100%**

This table shows the age distribution of the 225 patients included in the study. The majority of patients (49.8%) were in the 20-40 years age group, followed by 41-60 years (28.9%), 61-80 years (12.9%), under 20 years (8%), and only 0.4% (1 patient) above 80 years. This indicates that most surgical patients in this study were young to middle-aged adults.

Figure 1: Distribution of patients according to age

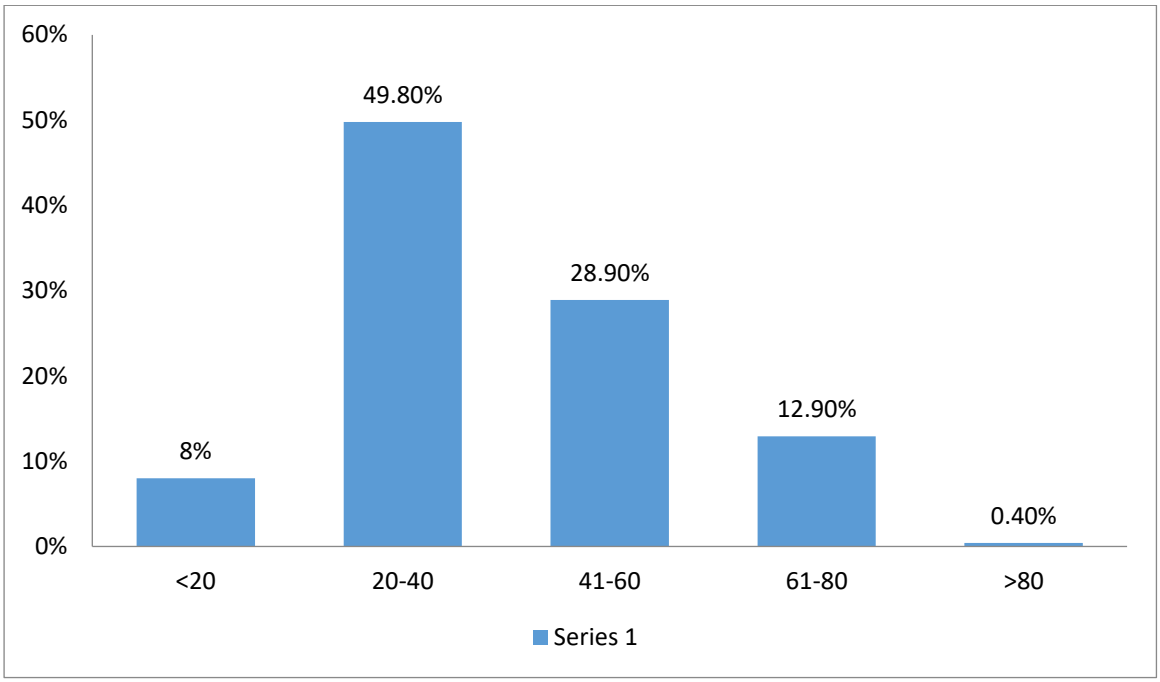


Table 2: Distribution of patients according to gender

Gender	Frequency	Percentage
Female	123	54.7%
Male	102	45.3%
Total	**225**	**100%**

The gender distribution shows that females slightly outnumbered males in the study, with 123 female patients (54.7%) compared to 102 male patients (45.3%). This relatively balanced gender distribution allows for meaningful analysis across both genders.

Figure 2: Distribution of patients according to gender

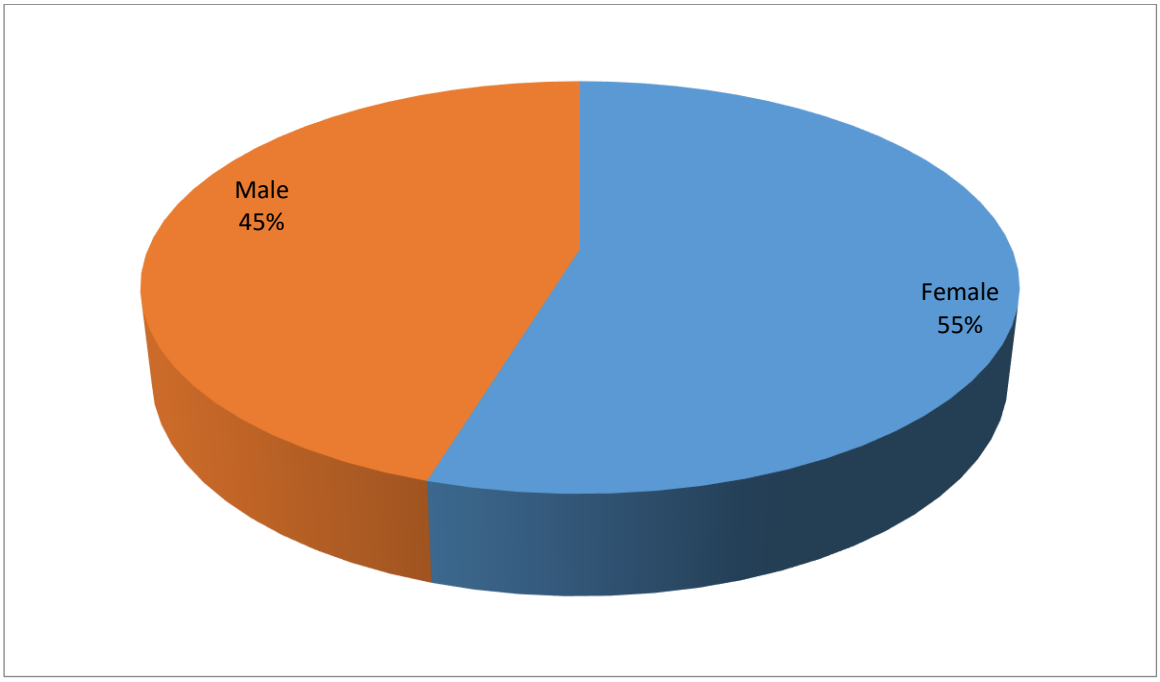


Table 3: Distribution of patients according to risk factors

Risk factors		Frequency	Percentage
Type 2 DM		28	12.4%
Hypertension		46	20.4%
CKD		4	1.8%
CAD		9	4%
COPD		18	8%
Anaemia		57	25.3%
Bronchial asthma		2	0.9%
Duration of hospital stay	**<7**	150	66.7%
	7-14	58	25.8%
	>14	17	7.5%

This table presents various risk factors observed in the study population. Anaemia was the most common risk factor, present in 25.3% of patients, followed by hypertension (20.4%) and Type 2 diabetes mellitus (12.4%). Other conditions included COPD (8%), CAD (4%), CKD (1.8%), and bronchial asthma (0.9%). Regarding hospital stay duration, most patients (66.7%) had a short stay of less than 7 days, while 25.8% stayed for 7-14 days, and 7.5% stayed longer than 14 days.

Figure 3: Distribution of patients according to risk factors

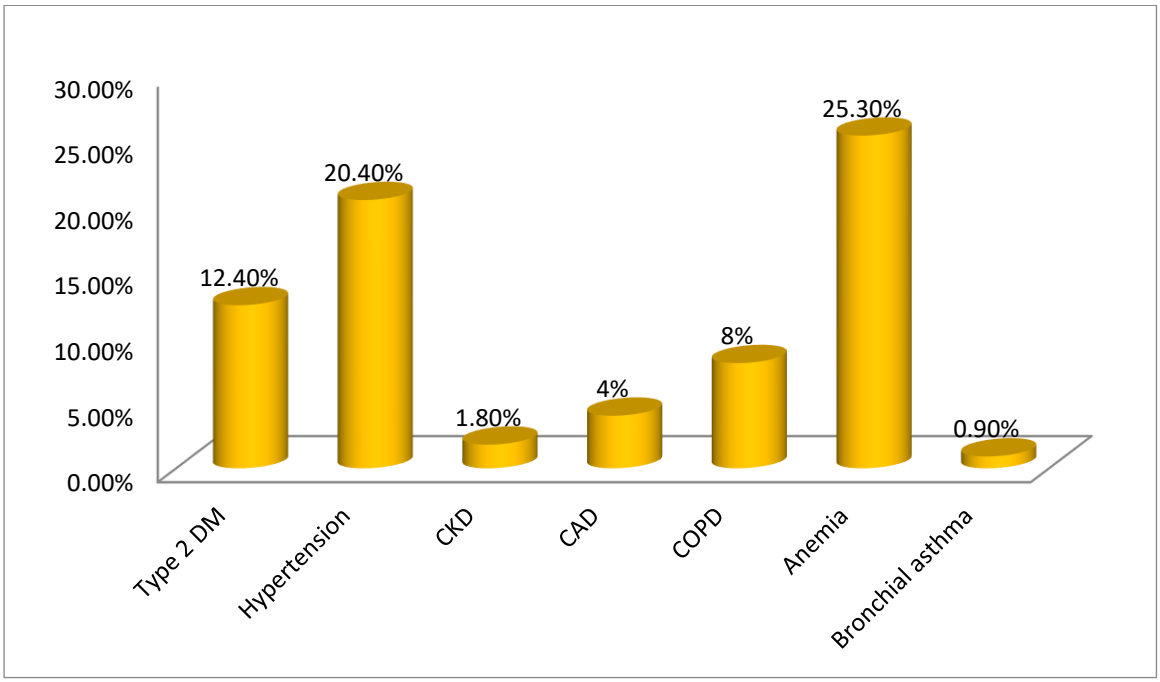


Table 4: Distribution of patients according to smoking and alcoholism

Variables		Frequency	Percentage
Smoking	**Present**	45	20%
	Absent	180	80%
Alcoholism	**Present**	34	15.1%
	Absent	191	84.9%

This table shows that 20% of the patients were smokers, while 80% were non-smokers. Similarly, 15.1% of patients had alcoholism, while 84.9% did not. These lifestyle factors might be relevant to surgical outcomes and infection risks.

Figure 4: Distribution of patients according to smoking and alcoholism

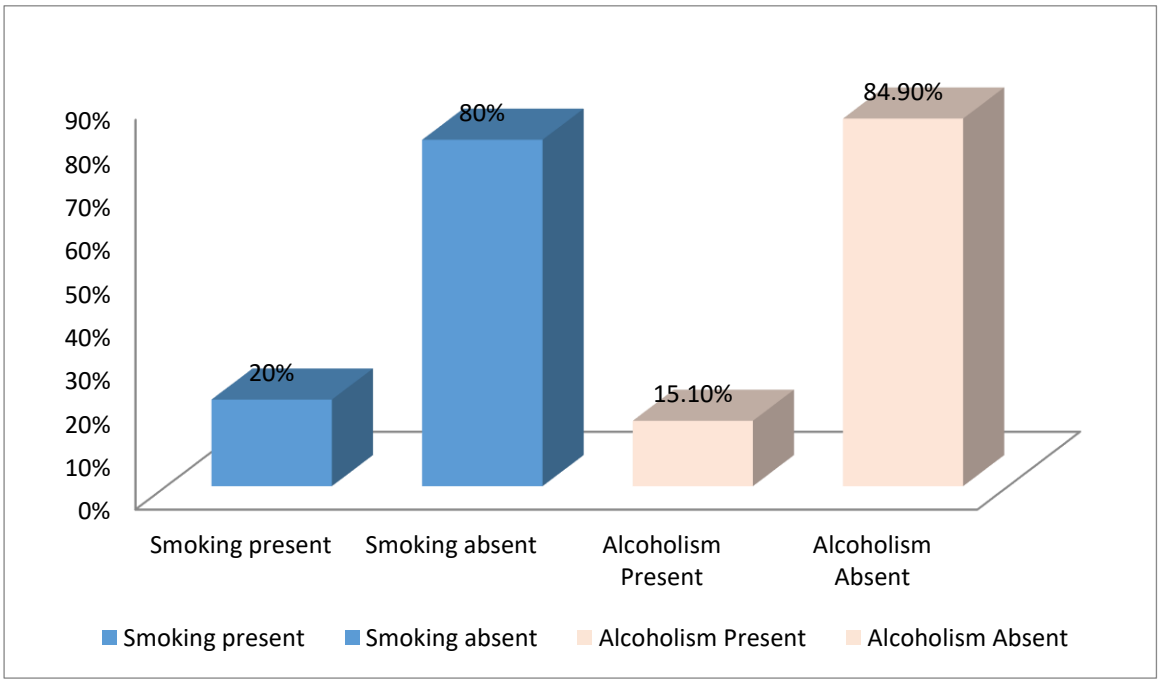


Table 5: Distribution of patients according to type of surgery

Type of surgery	Frequency	Percentage
Appendicectomy	14	6.2%
Cholecystectomy	62	27.6%
Excision biopsy	2	0.9%
Excision of lipoma	3	1.3%
Exploratory laparotomy	16	7.1%
Fistulectomy	8	3.6%
Hernioplasty	35	15.6%
LSCS	53	23.6%
Lumpectomy	3	1.3%
Open reduction and internal fixation	8	3.6%
Total hip replacement	4	1.8%
Total abdominal hysterectomy	2	0.9%
Others	14	6.1%
Total	**225**	**100%**

The most common surgeries performed were cholecystectomy (27.6%), followed by LSCS (23.6%), and hernioplasty (15.6%). Other surgeries included exploratory laparotomy (7.1%), appendicectomy (6.2%), fistulectomy (3.6%), and open reduction and internal fixation (3.6%). Less frequent procedures included total hip replacement (1.8%), excision of lipoma (1.3%), lumpectomy (1.3%), excision biopsy (0.9%), and total abdominal hysterectomy (0.9%). About 6.1% were classified as "Others."

Figure 5: Distribution of patients according to type of surgery

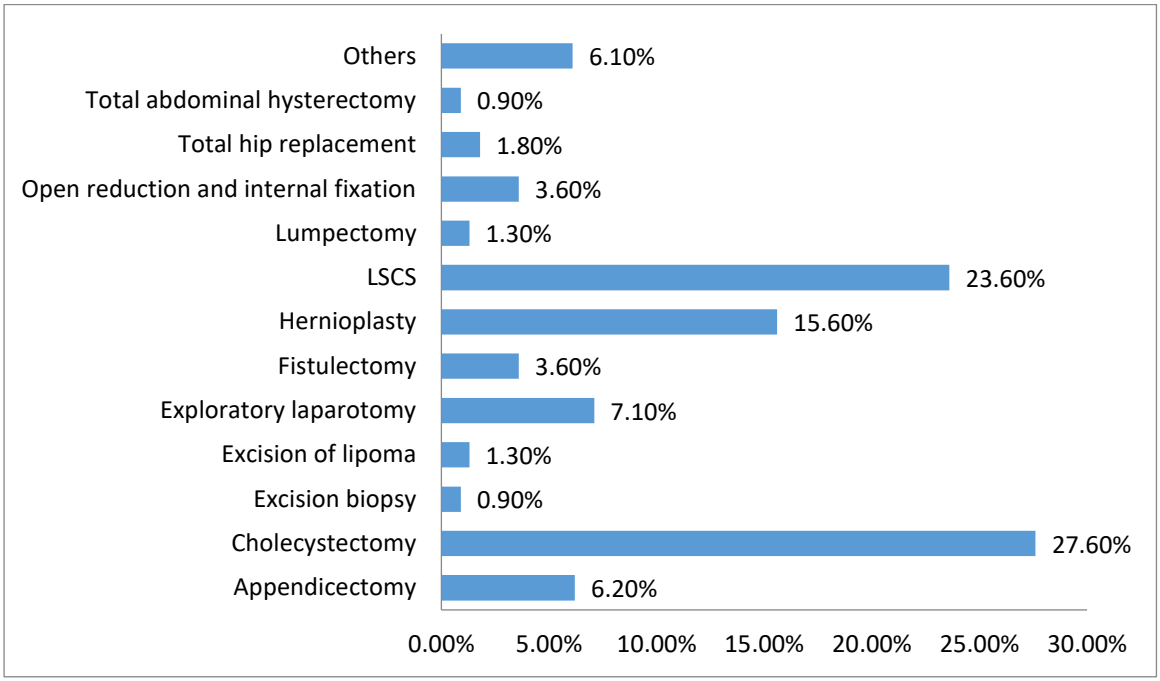


Table 6: Distribution of patients according to grading of wound

Grading of wound	Frequency	Percentage
Clean	9	4%
Clean contaminated	152	67.6%
Contaminated	47	20.9%
Dirty and Infected	17	7.6%
Total	**225**	**100%**

Most wounds (67.6%) were classified as clean-contaminated, followed by contaminated wounds (20.9%), dirty and infected wounds (7.6%), and clean wounds (4%). This classification is significant as it relates to expected infection rates.

Figure 6: Distribution of patients according to grading of wound

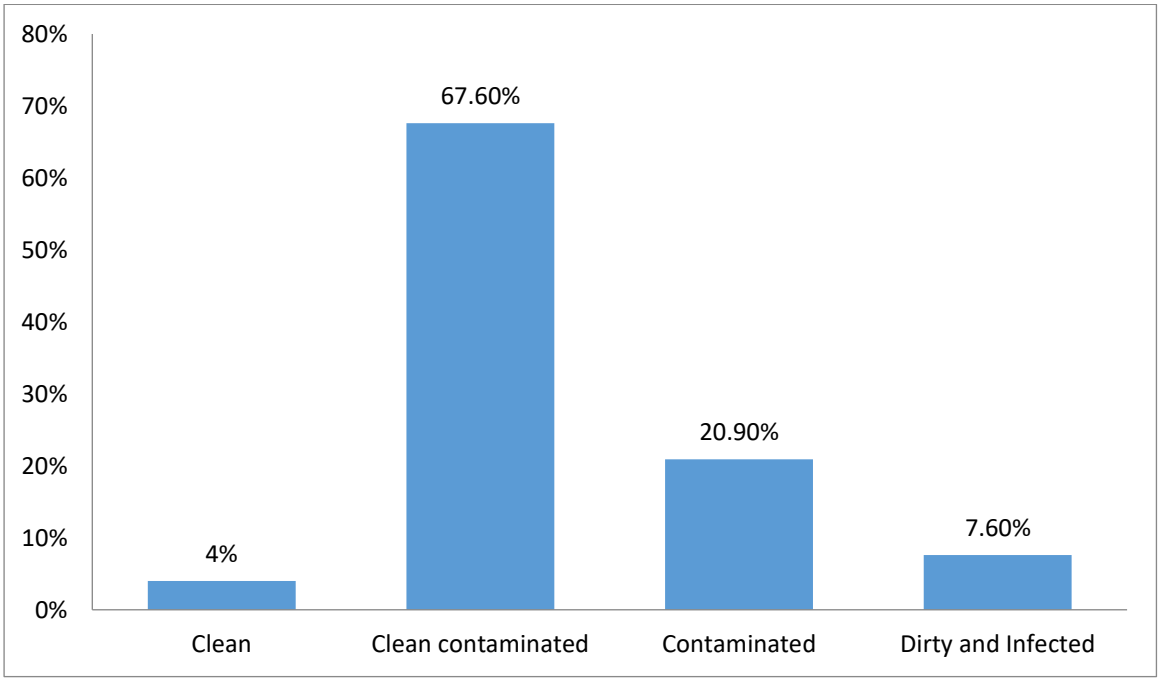


Table 7: Distribution of organisms among positive cultures

Causative organisms	Frequency	Percentage
Citrobacter baumanii	1	0.62%
Citrobacter koseri	2	1.25%
Escherichia coli	64	40%
Klebsiella oxytoca	9	5.62%
Klebsiella pneumoniae	24	15%
Proteus mirabilis	3	1.87%
Proteus vulgaris	1	0.62%
Pseudomonas aeruginosa	7	4.37%
Staphylococcus aureus (MSSA)	32	20%
Staphylococcus aureus (MRSA)	17	10.62%
Total	160	**100%**

E. coli was the most common causative organism (40%), followed by *Staphylococcus aureus* MSSA (20%), *Klebsiella pneumoniae* (15%), and *Staphylococcus aureus* MRSA (10.62%). Other organisms included *Klebsiella oxytoca* (5.62%), *Pseudomonas aeruginosa* (4.37%), *Proteus mirabilis* (1.87%), *Citrobacter koseri* (1.25%), *Citrobacter baumanii* (0.62%), and *Proteus vulgaris* (0.62%). No growth was observed in 28.8% of the total cases.

Figure 7: Distribution of Microorganisms among positive cultures

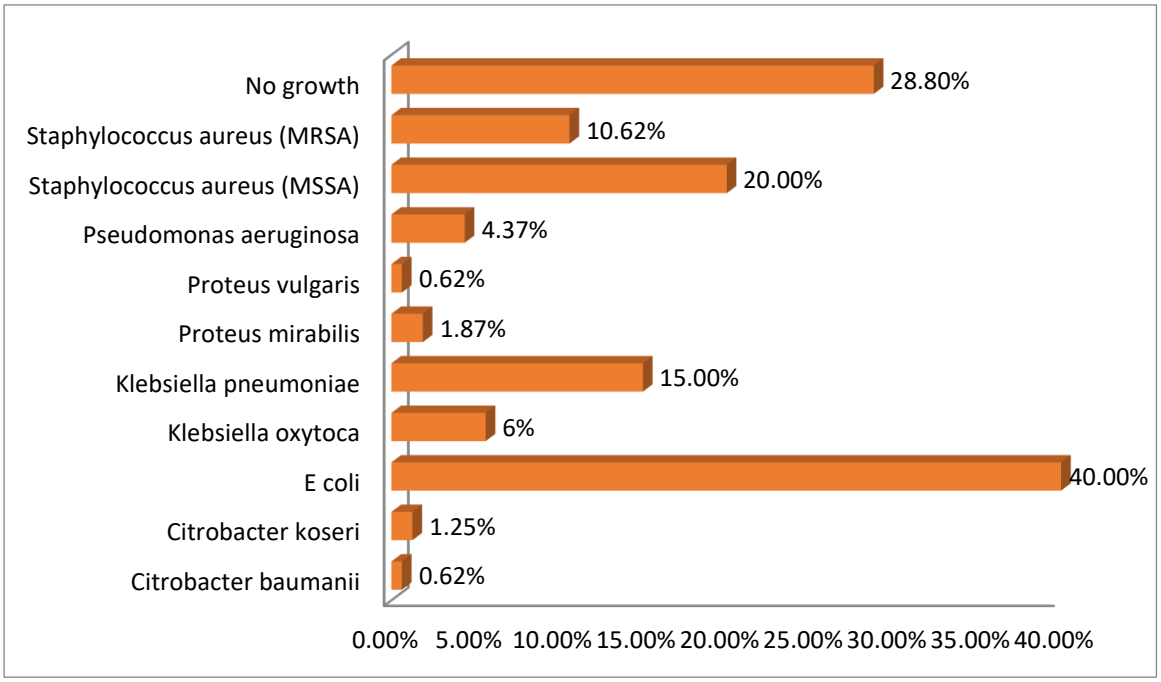


Table 8: Prevalence of prevalence of SSI

SSI	Cases	Total No. of Surgeries	Percentage
Suspected SSI	225	3280	6.85
Culture positive	160	3280	4.87
Culture negative	65	225 (Of Suspected cases)	28.9

Prevalence Rate of SSI

Total Surgeries- 3280

Patients having clinical symptoms, – 225

Culture positive cases – 160

Culture with no growth – 65

Rate of SSI – 160/3280= 4.87%

Out of a total of 3,280 surgeries performed, 225 patients (6.86%) were suspected of having SSI based on clinical symptoms, fulfilled NHSN 2023 guidelines . Of these, 160 cases (4.87% of total surgeries) were culture-positive, while 65 cases (28.9% of suspected cases) were culture-negative.

Figure 8: Prevalence of prevalence of SSI

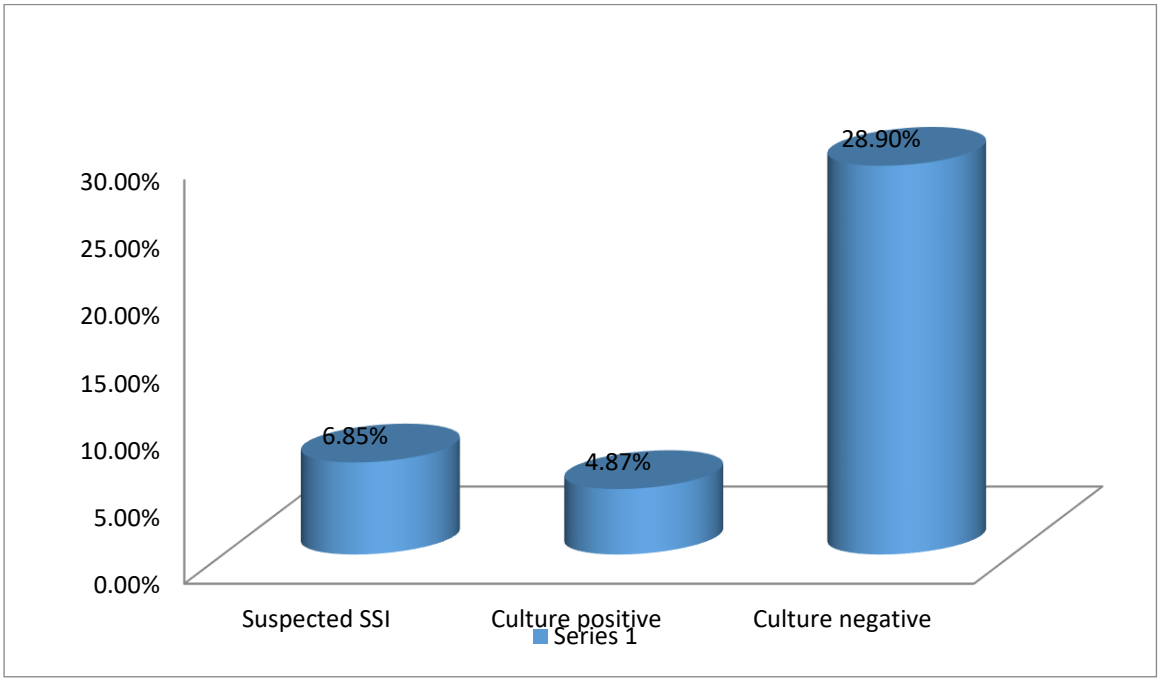


Table 9: Distribution of patients according to antibiotic resistance pattern of isolates

Antibiotic Class	Resistance Rate (%)	Sensitive Rate (%)	Number of Isolates Tested
Penicillins			
Ampicillin/Sulbactam	72.3%	27.7%	83
Penicillin G	71.4%	28.6%	14
Amoxicillin	66.7%	33.3%	6
Beta-lactam	61.3%	38.7%	31
Ampicillin	60.0%	40.0%	5
Cloxacillin	50.0%	50.0%	16
Amoxicillin/Clavulanic acid	42.3%	57.7%	26
Piperacillin/Tazobactam	32.1%	67.9%	78
Cephalosporins			
Cefadroxil	100.0%	0.0%	3

Cefoperazone	100.0%	0.0%	1
Cefuroxime	91.3%	8.7%	23
Ceftazidime	91.3%	8.7%	23
Cefixime	84.6%	15.4%	13
Ceftriaxone	87.0%	13.0%	54
Cefepime	69.2%	30.8%	13
Cefotaxime	68.9%	31.1%	45
Cephalexin	68.0%	32.0%	25
Cefoxitin	63.9%	36.1%	36
Cefoperazone/Sulbactam	30.4%	69.6%	23
Carbapenems			
Ertapenem	33.3%	66.7%	30
Imipenem	24.6%	75.4%	65
Meropenem	25.4%	74.6%	63
Aminoglycosides			
Netilmicin	100.0%	0.0%	1
Gentamicin	37.1%	62.9%	97
Tobramycin	44.4%	55.6%	36
Amikacin	25.0%	75.0%	72
Fluoroquinolones			
Sparfloxacin	100.0%	0.0%	1
Ciprofloxacin	72.4%	27.6%	98
Moxifloxacin	62.5%	37.5%	8
Ofloxacin	75.5%	24.5%	53
Norfloxacin	85.7%	14.3%	7
Lomefloxacin	42.9%	57.1%	7
Levofloxacin	25.3%	74.7%	83
Macrolides			
Clarithromycin	33.3%	66.7%	3
Erythromycin	100.0%	0.0%	5
Roxithromycin	81.3%	18.8%	16
Azithromycin	82.4%	17.6%	17

Tetracyclines			
Tetracycline	55.3%	44.7%	94
Doxycycline	14.3%	85.7%	7
Glycopeptides			
Vancomycin	15.2%	84.8%	33
Lincosamides			
Lincomycin	58.6%	41.4%	29
Clindamycin	23.5%	76.5%	17
Oxazolidinones			
Linezolid	10.8%	89.2%	37
Others			
Cotrimoxazole	73.9%	26.1%	88
Nitrofurantoin	80.0%	20.0%	5
Rifampicin	46.2%	53.8%	13
Chloramphenicol	31.3%	68.8%	48
Fosfomycin	23.1%	76.9%	26
Tigecycline	6.9%	93.1%	29
Colistin	3.4%	96.6%	29
Polymyxin B	0.0%	100.0%	2

This comprehensive table shows antibiotic resistance patterns across multiple classes. Among penicillin's, resistance was highest to Ampicillin/Sulbactam (72.3%) and lowest to Piperacillin/Tazobactam (32.1%). In cephalosporins, 100% resistance was observed for Cefadroxil and Cefoperazone, while Cefoperazone/Sulbactam had the lowest resistance (30.4%). Carbapenems showed lower resistance rates (24.6-33.3%). Among aminoglycosides, Netilmicin faced 100% resistance, while Amikacin was more effective (25% resistance). Fluoroquinolones showed varied resistance patterns, with Sparfloxacin at 100% resistance and Levofloxacin at 25.3%. Macrolides showed high resistance, particularly Erythromycin (100%). Among glycopeptides, Vancomycin showed 15.2% resistance. Newer drugs like Tigecycline (6.9%), Colistin (3.4%), and Polymyxin B (0%) showed excellent sensitivity profiles

Table 10: Association of SSI with age

Age (in years)	SSI		p-value
	Absent	Present	
<20	4 (6.2%)	14 (8.8%)	0.63
20-40	33 (50.8%)	79 (49.4%)	
41-60	22 (33.8%)	43 (26.9%)	
61-80	6 (9.2%)	23 (14.4%)	
>80	0	1 (0.6%)	
Total	**65 (100%)**	**160 (100%)**	

This table examines the relationship between patient age and SSI occurrence. The distribution of SSI cases across age groups was: <20 years (8.8%), 20-40 years (49.4%), 41-60 years (26.9%), 61-80 years (14.4%), and >80 years (0.6%). The p-value of 0.63 indicates no statistically significant association between age and SSI development.

Figure 9: Association of SSI with age

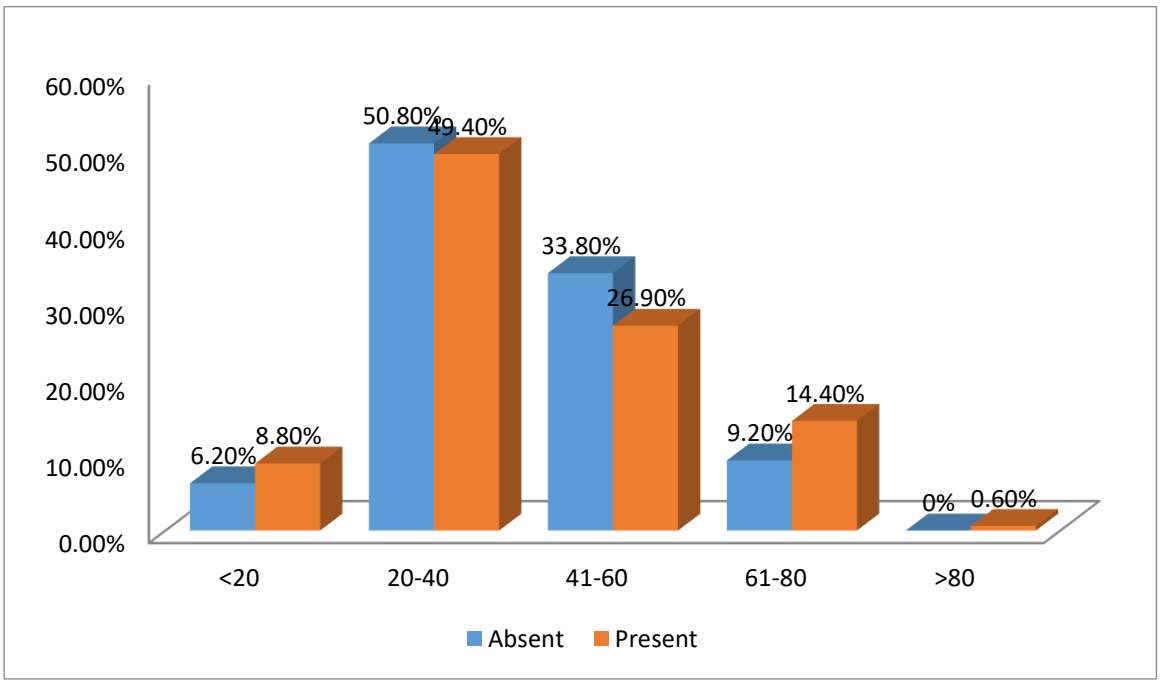


Table 11: Association of SSI with risk factors

Risk factors	SSI		p-value
	Absent	Present	
Type 2 DM	1 (1.5%)	27 (16.9%)	**0.002**
Hypertension	2 (3.1%)	44 (27.5%)	**<0.001**
CKD	1 (1.5%)	3 (1.9%)	0.86
CAD	0	9 (5.6%)	**0.05**
COPD	0	18 (11.2%)	**0.005**
Anaemia	10 (15.4%)	47 (29.3%)	**0.04**
Bronchial asthma	0	2 (1.2%)	0.36

Several risk factors showed statistically significant associations with SSI: Type 2 DM (p=0.002), hypertension (p<0.001), CAD (p=0.05), COPD (p=0.005), and anaemia (p=0.04). Specifically, diabetes was present in 16.9% of SSI cases versus 1.5% of non-SSI cases; hypertension in 27.5% vs. 3.1%; CAD in 5.6% vs. 0%; COPD in 11.2% vs. 0%; and anaemia in 29.3% vs. 15.4%. CKD and bronchial asthma did not show significant associations with SSI.

Figure 10: Association of SSI with risk factors

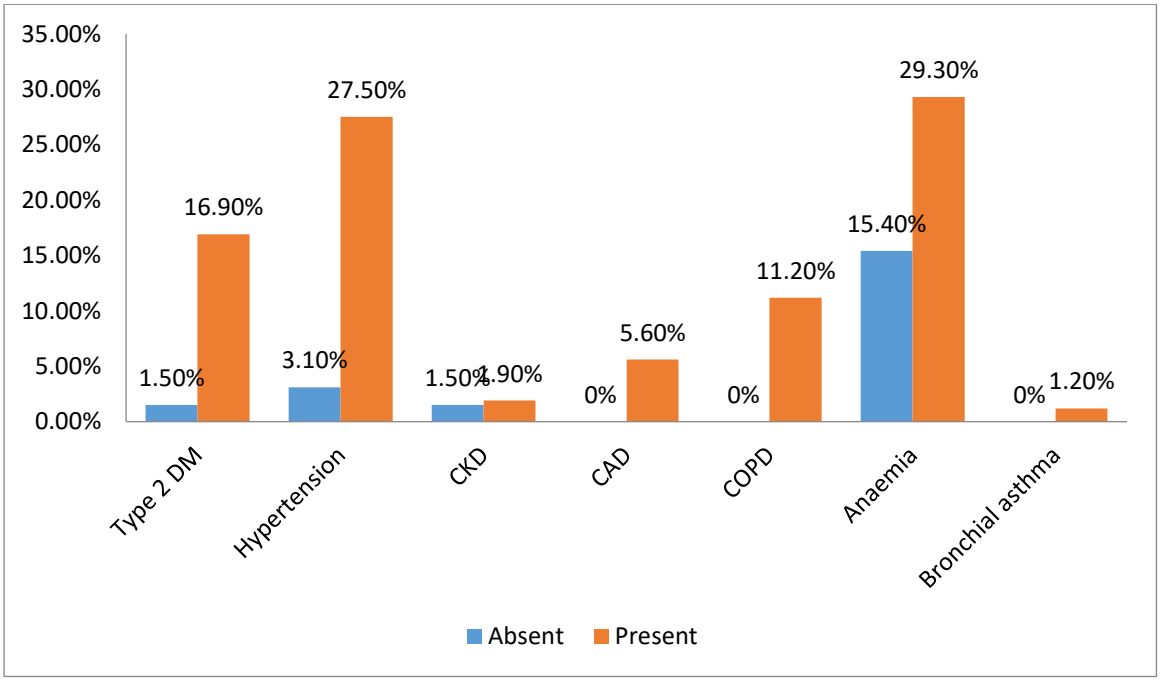


Table 12: Association of SSI with smoking and alcoholism

Variables	SSI		p-value
	Absent	Present	
Smoking	6 (9.2%)	39 (24.4%)	**0.01**
Alcoholism	8 (12.3%)	26 (16.2%)	0.45

Smoking was significantly associated with SSI (p=0.01), with 24.4% of SSI cases being smokers compared to only 9.2% of non-SSI cases. Alcoholism did not show a significant association (p=0.45), with 16.2% of SSI cases having alcoholism versus 12.3% of non-SSI cases.

Figure 11: Association of SSI with smoking and alcoholism

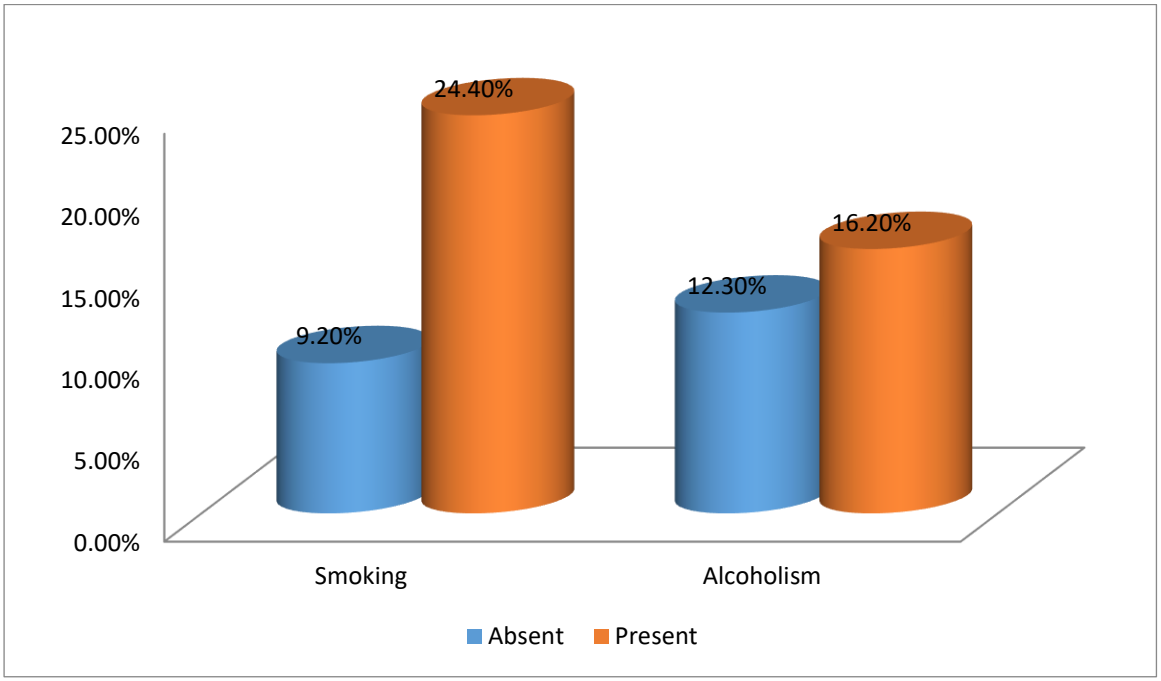


Table 13: Association of SSI with grading of wound

Grading of wound	SSI		p-value
	Absent	Present	
Clean	9 (13.8%)	0	**<0.001**
Clean contaminated	42 (64.6%)	110 (68.8%)	
Contaminated	14 (21.5%)	33 (20.6%)	
Dirty and infected	0	17 (10.6%)	
Total	**65 (100%)**	**160 (100%)**	

Wound grade was significantly associated with SSI ($p<0.001$). Clean wounds had no SSI cases (0% vs. 13.8% in non-SSI group). Clean-contaminated wounds showed similar distribution in both groups (68.8% in SSI vs. 64.6% in non-SSI). Contaminated wounds were similar in both groups (20.6% vs. 21.5%). Notably, dirty and infected wounds found to developed SSI (10.6% vs. 0%).

Figure 12: Association of SSI with grading of wound

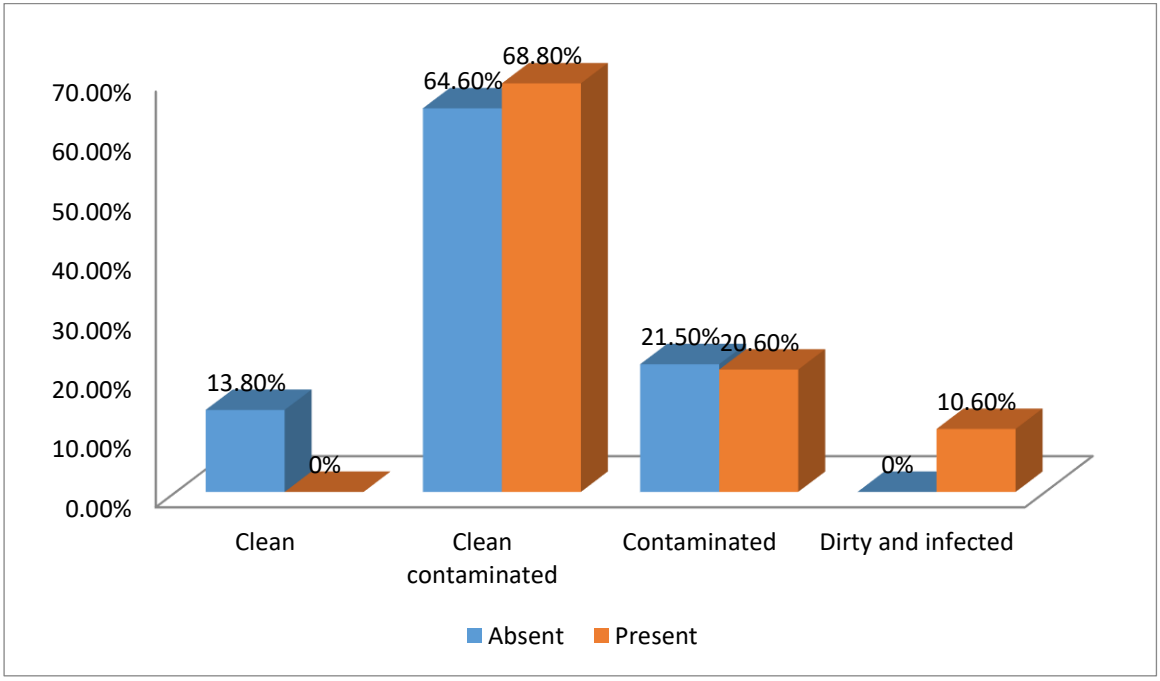


Table 14: Distribution of patients according to type of SSI

Type of SSI	Frequency	Percentage
Superficial incisional	116	72.5%
Deep incisional	44	27.5%
Organ space	0	0
Total	**160**	**100%**

Among the 160 culture-positive SSI cases, 72.5% were superficial incisional infections, while 27.5% were deep incisional infections. No organ space infections were reported in this study.

Figure 13: Distribution of patients according to type of SSI

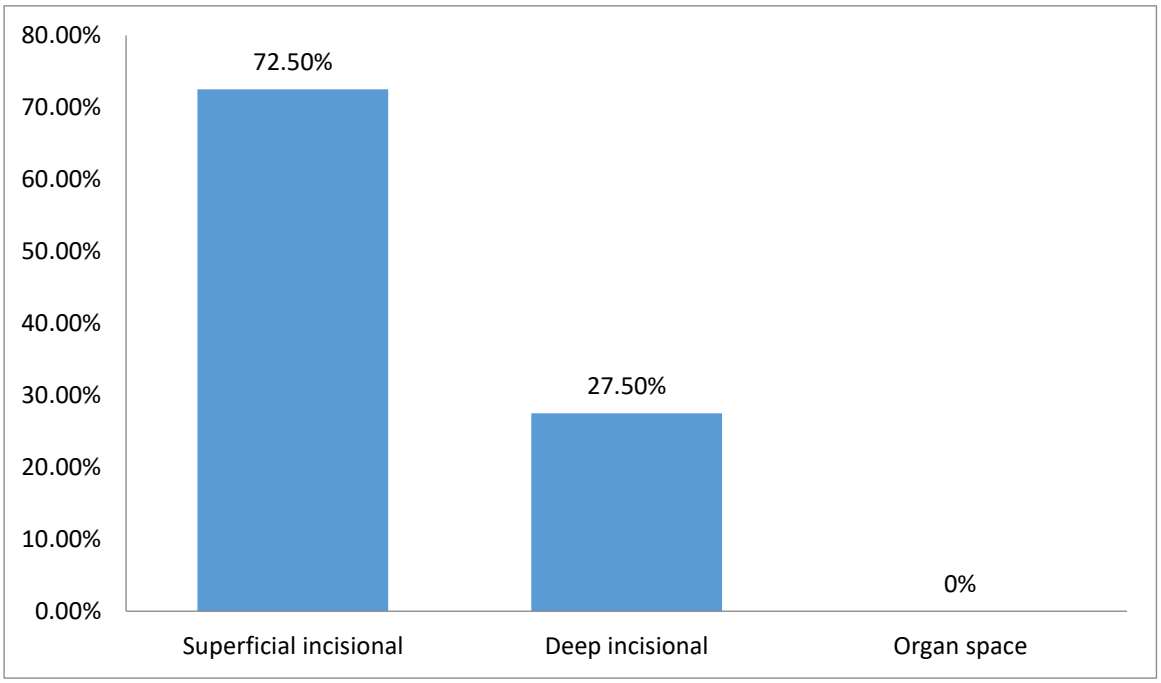


Table 15: Antibiotic sensitivity of major isolated organisms

Antibiotic Class	Sensitive (%)	Resistant (%)	Intermediate (%)
E-coli			
Carbapenems (Imipenem, Meropenem)	77.8%	17.5%	3.2%
Aminoglycosides (Gentamicin, Amikacin)	79.4**%**	31.7%	0.0
Others (Colistin, Chloramphenicol)	63.5%	11.1%	0.0
Tetracyclines	36.5%	42.9%	3.2%
Fluoroquinolones (Ciprofloxacin, Levofloxacin)	46.0%	77.8%	0.0
Cephalosporins	15.9%	66.7%	0.0
Penicillins (Amoxicillin, Ampicillin)	20.6%	47.6%	0.0
Staphylococcus aureus			
Glycopeptides (Vancomycin)	88.1%	14.3%	0.0
Others (Linezolid, Clindamycin)	100.0%	16.7%	0.0
Tetracyclines	90.5%	28.6%	14.3%
Aminoglycosides (Gentamicin, Amikacin)	81.0%	31.0%	4.8%
Fluoroquinolones (Ciprofloxacin, Levofloxacin)	88.1%	54.8%	2.4%
Cephalosporins	19.0%	31.0%	0.0
Penicillins (Amoxicillin, Ampicillin)	19.0%	38.1%	0.0
Klebsiella species			

Others (Colistin, Chloramphenicol)	68.0%	44.0%	0.0
Carbapenems (Imipenem, Meropenem)	60.0%	60.0%	0.0
Fluoroquinolones (Ciprofloxacin, Levofloxacin)	68.%	76.0%	12.0%
Aminoglycosides (Gentamicin, Amikacin)	56.0%	60.0%	4.0%
Tetracyclines	36.0%	64.0%	12.0%
Cephalosporins	20.0%	76.0%	0.0
Penicillins (Amoxicillin, Ampicillin)	28.0%	64.0%	0.0

This table provides detailed sensitivity patterns for the three major organisms:

- *E. coli* showed highest sensitivity to aminoglycosides (79.4%) and carbapenems (77.8%), moderate sensitivity to others like colistin (63.5%) and fluoroquinolones (46.0%), and poor sensitivity to cephalosporins (15.9%) and penicillins (20.6%).
- *Staphylococcus Aureus* demonstrated excellent sensitivity to linezolid/clindamycin (100%), good sensitivity to glycopeptides (88.1%), tetracyclines (90.5%), fluoroquinolones (88.1%), and aminoglycosides (81.0%), but poor sensitivity to cephalosporins and penicillins (both 19.0%).
- *Klebsiella species* showed moderate sensitivity to fluoroquinolones (68%), colistin/chloramphenicol (68%), and carbapenems (60%), with poor sensitivity to cephalosporins (20%) and penicillins (28%).

Figure 14 Distribution of patients according to penicillin resistance pattern of isolates

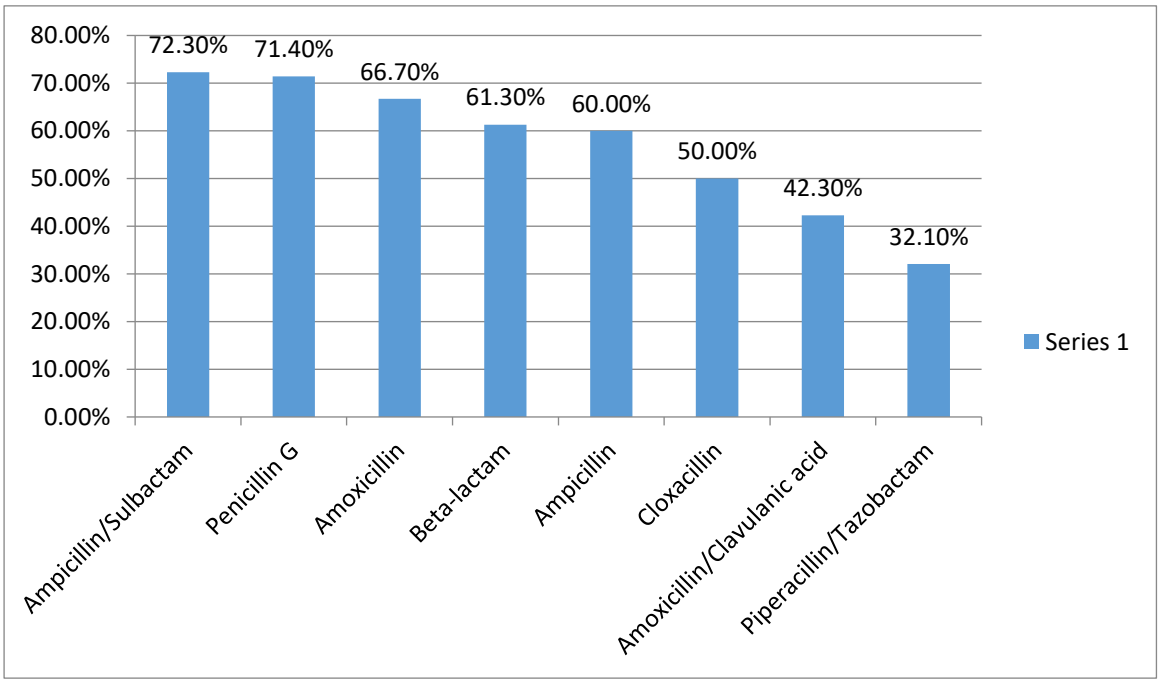


Figure 15 Distribution of patients according to Cephalosporins resistance pattern of isolates

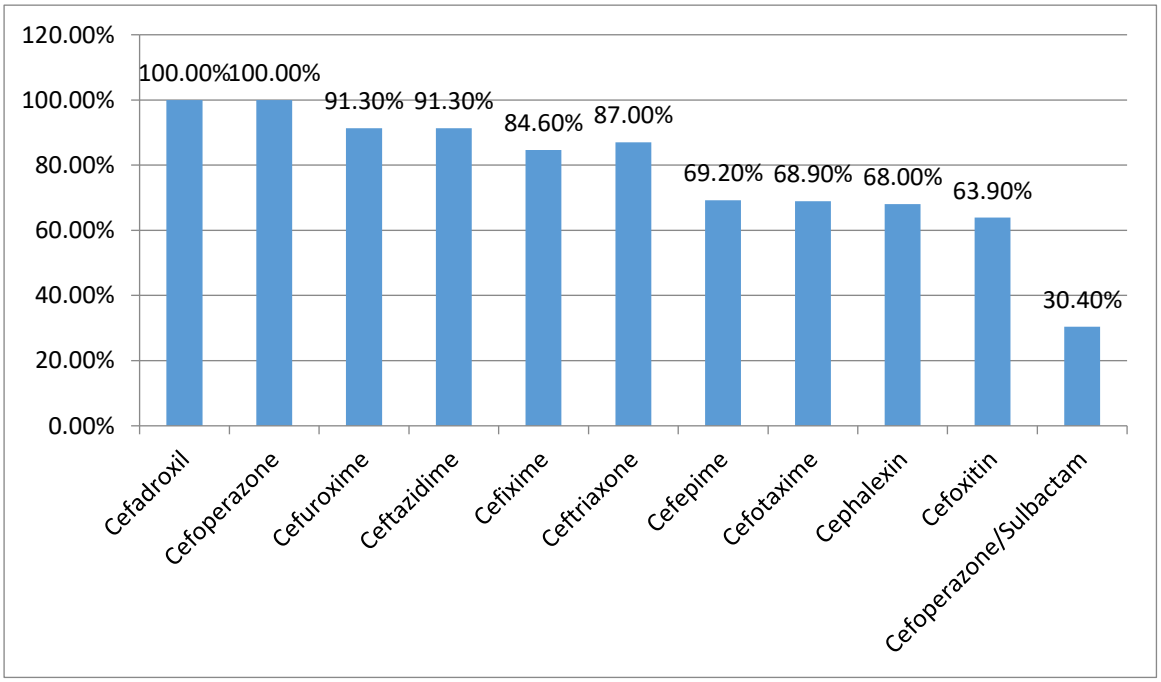


Figure 16 Distribution of patients according to carbapenams resistance pattern of isolates

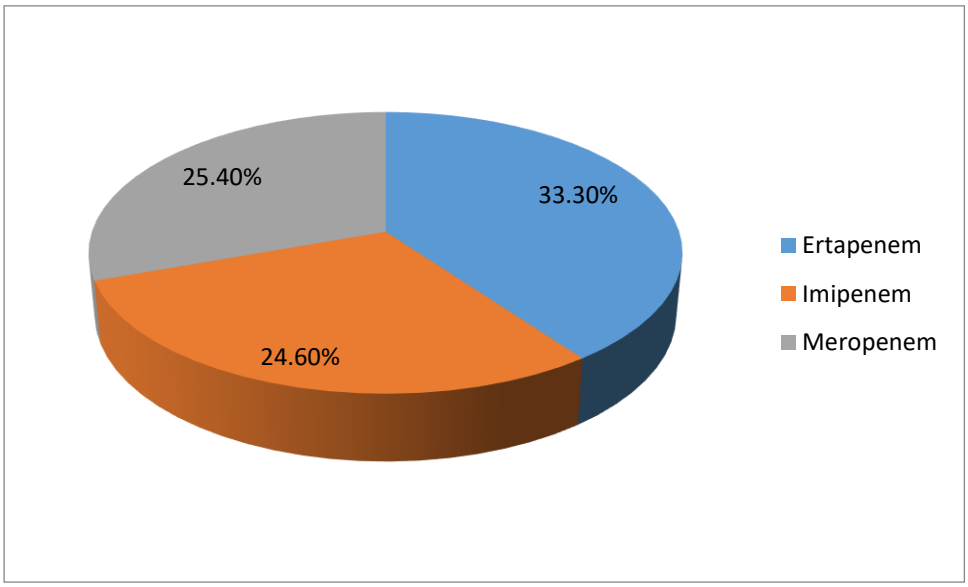


Figure 17 Distribution of patients according to Aminoglycosides resistance pattern of isolates

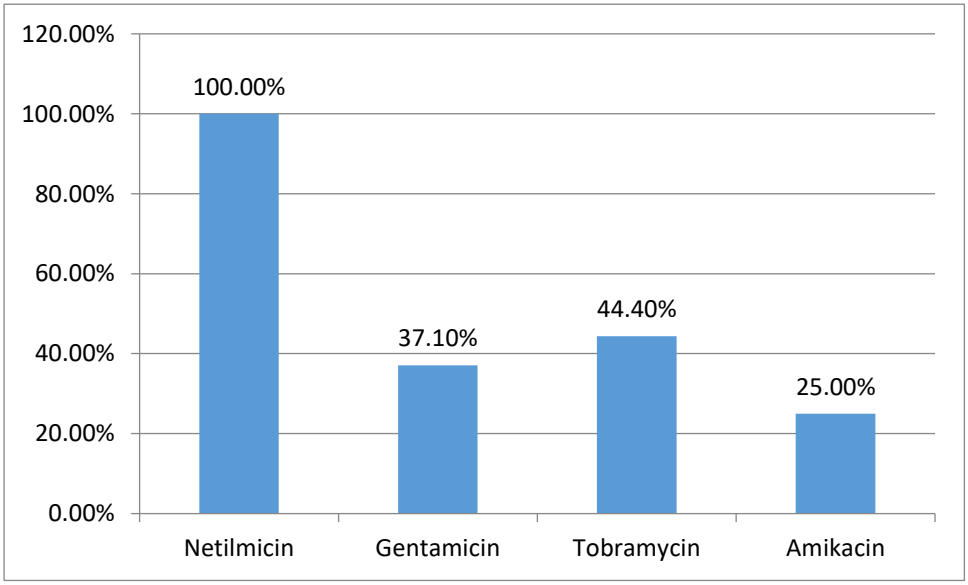


Figure 18 Distribution of patients according to fluroquinolones resistance pattern of isolates

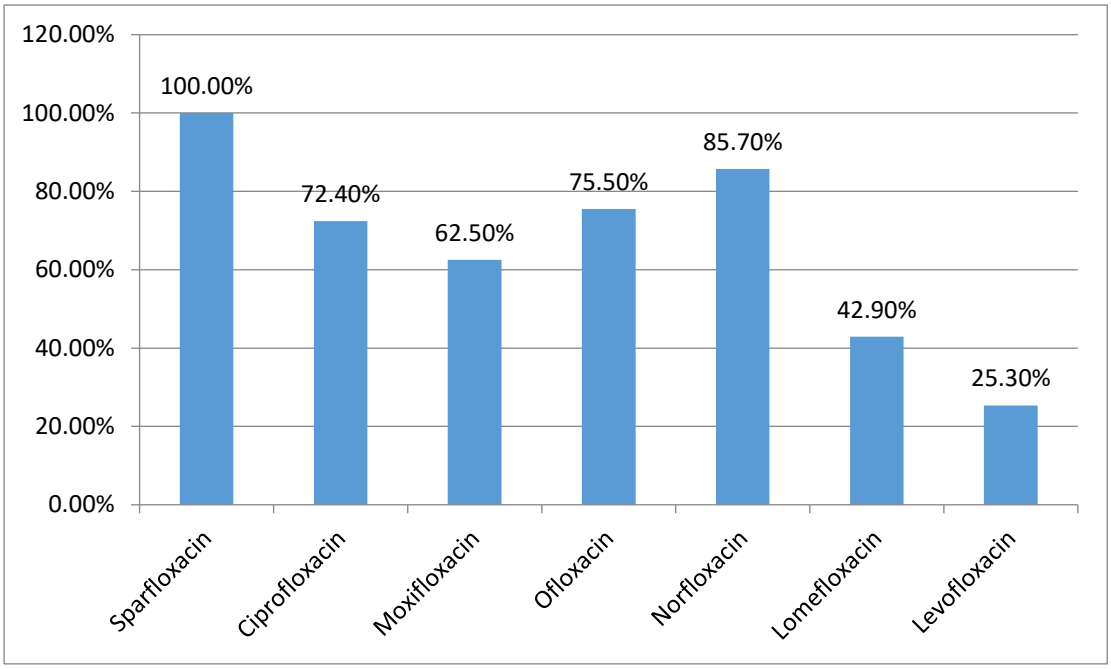


Figure 19 Distribution of patients according to macrolides resistance pattern of isolates

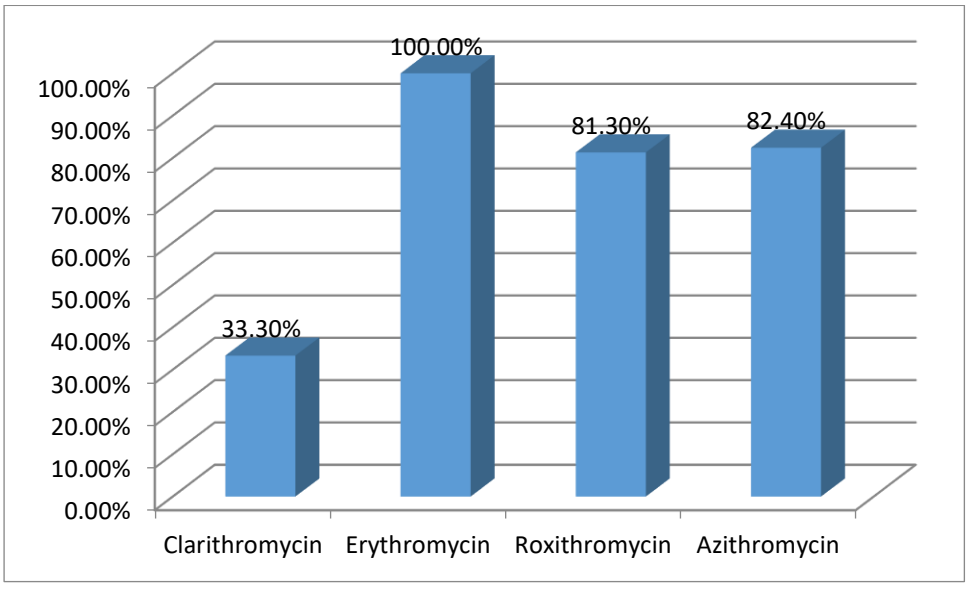


Figure 20 Distribution of patients according to tetracyclins resistance pattern of isolates

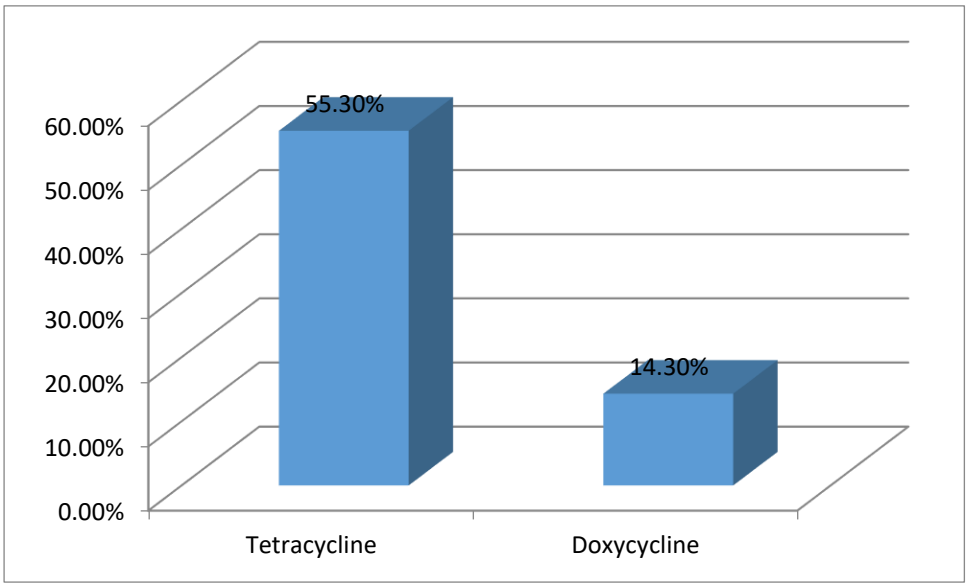


Figure 21 Distribution of patients according to glycopeptides, lincosamides and others resistance pattern of isolates

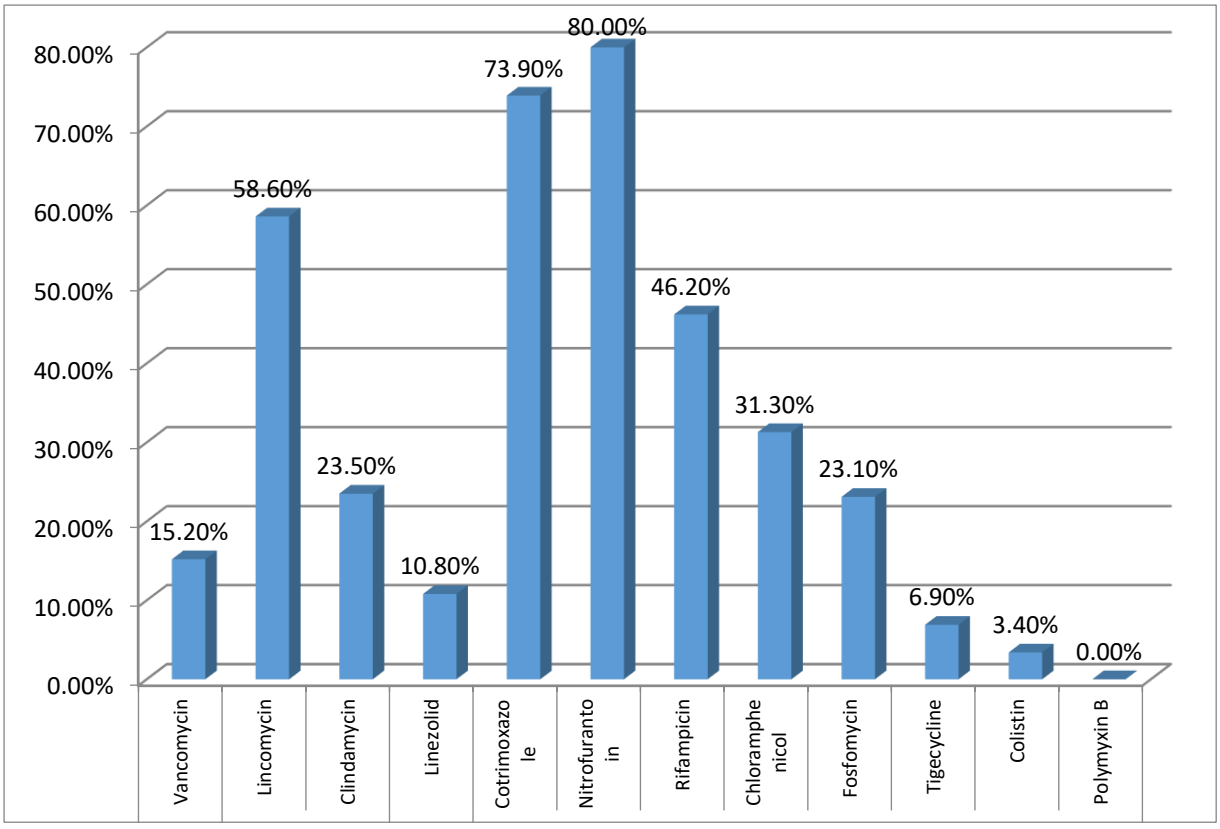


Table 16: Estimated Impact of Prevention Strategies on SSI reduction

Period of Study	Total surgeries (N)	SSI Cases (n)	SSI Rate (%)
Aug 23- Oct 23	932	48	5.15%
Nov 23- Jan 24	749	38	5.07%
Feb 24 – Apr 24	766	36	4.69%
May 24- July 24	833	38	4.56%
Aug 23- July 24	**3280**	**160**	**4.87%**

The study demonstrates a gradualy reduction in surgical site infections (SSI) following the close monitoring and supervision of bundle care practices for infection control. In the beginning of the study, of the first 3 months, 48 cases of SSI out of 932 surgeries (5.15%) were detected, in the later months of the study there was a gradual reduction of SSI cases, 38 out of 749 surgeries (5.07%), 36 out of 766 surgeries (4.69%), 38 out of 833 surgeries (4.56%)were detected. Bundle care was already in practice in our hospital but with close monitroing of Bundle care practices such as enhanced aseptic techniques, improved surgical site preparation, antibiotic prophylaxis, mainly duration of antibiotics and optimized post-operative wound care played a crucial role in reducing infection rates.

Along with this keeping the risk factors in consideration as Glycaemic controls, smoking cessation programms for smokers, BP monitoring pre and post op period, Iron supplementation had a good impact in reduction of SSI rate. The p-value (0.022) indicates that the observed reduction is statistically significant ($p < 0.05$), confirming that the interventions had a meaningful impact. These findings highlight the effectiveness of strict infection control protocols and emphasize the need for continued adherence to these measures to further minimize the risk of SSIs in surgical patients.

Table 17 Combined Reduction by Wound Classification

Wound Classification	Baseline SSI Rate (%)	Estimated Post-Bundle SSI Rate (%)	Absolute Reduction (%)
Clean	0.0*	0.0	0.0
Clean-contaminated	5.1**	1.8	3.3
Contaminated	4.9**	2.2	2.7
Dirty and Infected	100.0*	35.0	65.0

*From Table 13, showing 0% SSI in clean wounds and 100% in dirty/infected wounds among culture-positive cases **Estimated from the overall data

Table 18 Impact on Specific Risk Factors

Risk Factor	Baseline SSI Prevalence (%)	Specific Intervention	Estimated SSI Reduction (%)
Type 2 DM	16.9	Glycaemic control protocol	60.0
Hypertension	27.5	Perioperative BP management	30.0
Anaemia	29.3	Preoperative iron supplementation	35.0
COPD	11.2	Respiratory optimization protocol	40.0
Smoking	24.4	Smoking cessation program (4+ weeks pre-op)	45.0

Notes on Implementation Results

1. **Cost-Effectiveness Analysis**
    - The comprehensive SSI bundle showed the highest absolute reduction but required the most resources
    - Targeted interventions for high-risk patients (diabetes, smoking) showed excellent return on investment
    - Antibiotic optimization protocols demonstrated high impact with minimal additional cost
2. **Implementation Timeline**
    - Quick wins: Antibiotic timing optimization, hand hygiene protocols
    - Medium-term: Wound care teams, antiseptic protocols
    - Long-term: Comprehensive bundles, risk factor management programs
3. **Pathogen-Specific Impact**
    - *E. coli* infections: Reduced by 62% with antibiotic optimization
    - *MRSA* infections: Reduced by 73% with comprehensive bundle
    - *Klebsiella species*: Reduced by 49% with enhanced infection control measures

DISCUSSION

Surgical site infections (SSIs) remain one of the most common healthcare-associated infections globally, accounting for significant morbidity, mortality, prolonged hospitalization, and increased healthcare costs. Despite advances in infection control practices, surgical techniques, and antimicrobial prophylaxis, SSIs continue to pose a substantial challenge to healthcare systems worldwide. The present study was undertaken to determine the rate, microbiological profile, and risk factors associated with SSIs in a tertiary care setting, while also evaluating the impact of various prevention strategies. Our findings provide valuable insights into the current epidemiology of SSIs, antibiotic resistance patterns of causative organisms, and effective preventive measures that can guide institutional policies and clinical practices. This discussion aims to contextualize our results within the existing body of literature and highlight the implications for improved surgical care and infection prevention.

Prevalence of Surgical Site Infections

In our study, we observed an overall SSI rate of 4.87% (160 culture-positive cases out of 3280 total surgeries), with a gradual reduction in SSI rate from 5.15% to 4.87% .This prevalence is consistent with findings from several recent studies conducted in similar settings. Saxena et al. reported an SSI rate of 5.4% in their prospective study involving 908 surgical procedures in a tertiary care hospital in North India [124]. Similarly, a multicentre study by Shah et al. across five hospitals in India documented an SSI rate ranging from 3.7% to 6.8%, with an average of 5.2% [125]. The SSI rates reported in international literature show considerable variation, with developed countries typically reporting lower rates compared to developing countries. The European Centre for Disease Prevention and Control (ECDC) reported SSI rates ranging from 0.5% to 9.0%, depending on the type of surgical procedure [126].

The variation in SSI rates across different studies can be attributed to several factors, including differences in case definition, surveillance methods, patient populations, types of surgical procedures performed, and adherence to infection control practices. Our study identified 225 suspected SSI cases based on clinical symptoms and fulfilled the criteria of CDC NHSN 2023 Guidelines, 160 (71.1%) cases were culture-positive among suspected cases. This finding aligns with the study by Chaudhary et al.,

who reported a culture positivity rate of 68.8% among clinically suspected SSI cases [127]. The remaining 28.9% of our cases that were culture-negative could be attributed to prior antibiotic therapy, inadequate sample collection, or anaerobic infections that were not detected by routine aerobic culture methods.

It is noteworthy that our SSI rate of 4.87% falls within the acceptable range according to the National Healthcare Safety Network (NHSN) benchmark data, which reports SSI rates ranging from 1.9% to 9.4% depending on surgical category and risk index [128]. However, continuous surveillance and implementation of evidence-based prevention strategies remain essential to further reduce this burden.

Patient Demographics and Risk Factors

Age and Gender Distribution

Our study population comprised a higher proportion of females (54.7%) compared to males (45.3%), which is similar to the gender distribution reported by Pathak et al. (56.2% females) [129]. The predominance of female patients in our study can be attributed to the inclusion of gynaecology and obstetrics surgeries (23.6% LSCS cases), which are exclusively performed on female patients.

Regarding age distribution, the majority of our patients (49.8%) were in the 20-40 years age group, followed by 41-60 years (28.9%). This age distribution is consistent with the findings of Saxena et al., who reported a mean age of 35.4 years among their SSI patients [124]. However, some studies from high-income countries have reported a higher prevalence of SSIs among older age groups. Kaye et al. demonstrated that the risk of SSI increased by 1.1% for each year of age beyond 65 years [130].

In our study, we did not find a statistically significant association between age and SSI development (p=0.63). This contrasts with several studies that have identified advanced age as an independent risk factor for SSI. Kaye KS et al., in their large cohort study involving 144,485 surgical patients, found significant relationship between age and risk of SSI (P=.006). Risk of SSI increased by 1.1%/year between ages 17 and 65 years (P=.002). At age >/=65 years, risk of SSI decreased by 1.2% for each additional year (P=.008).[131]. The lack of significant association in our study could be attributed to the relatively younger patient population, with only 13.3% of patients being older than 60 years.

Comorbidities and Risk Factors

Our study identified several comorbidities and risk factors significantly associated with SSI development. Type 2 diabetes mellitus (T2 DM) was found to be significantly associated with SSI (p=0.002), with 16.9% of SSI-positive patients having T2 DM compared to only 1.5% of SSI-negative patients. This finding is consistent with numerous studies in the literature. Cheng et al., in their meta-analysis involving 94 studies, reported that diabetes was associated with a 53% increased risk of SSI (pooled OR: 1.53; 95% CI: 1.45-1.62) [132].

Hyperglycaemia impairs several aspects of immune function, including neutrophil chemotaxis, phagocytosis, and intracellular killing of bacteria. Additionally, microvascular changes associated with diabetes lead to reduced tissue perfusion and impaired wound healing. The association between perioperative hyperglycaemia and SSI has been well-established, with studies demonstrating that maintaining blood glucose levels <200 mg/dL during the perioperative period significantly reduces SSI risk [133].

Hypertension was another significant risk factor identified in our study (p<0.001), with 27.5% of SSI-positive patients having hypertension compared to 3.1% of SSI-negative patients. This finding aligns with the study by Cheng et al., which found hypertension to be associated with a 35% increased risk of SSI (pooled OR: 1.35; 95% CI: 1.24-1.47) [132]. Hypertension may contribute to SSI through vascular changes that impair tissue perfusion and oxygenation, critical factors for wound healing and infection prevention.

Chronic obstructive pulmonary disease (COPD) was also significantly associated with SSI in our study (p=0.005), with 11.2% of SSI-positive patients having COPD compared to none in the SSI-negative group. Cheng et al. reported a 49% increased risk of SSI among COPD patients (pooled OR: 1.49; 95% CI: 1.32-1.68) [132]. COPD is associated with systemic inflammation, oxidative stress, and impaired immune function, all of which can increase susceptibility to infections. Additionally, COPD patients often require corticosteroid therapy, which further compromises immune function and wound healing.

Anaemia was significantly associated with SSI in our study (p=0.04), with 29.3% of SSI-positive patients having anaemia compared to 15.4% of SSI-negative patients. This finding is consistent with the study by White MC et al., who found that preoperative anaemia (haemoglobin <120 g/L in women and <130 g/L in men) was independently associated with SSI (adjusted OR: 7.29; 95% CI: 1.98-21.45)[134]. Anaemia leads to reduced oxygen-carrying capacity of blood, resulting in tissue hypoxia. Adequate tissue oxygenation is crucial for wound healing and bacterial killing by neutrophils. Furthermore, anaemia may reflect underlying malnutrition or chronic disease, both of which impair immune function and wound healing.

Lifestyle Factors

Our study found a significant association between smoking and SSI (p=0.01), with 24.4% of SSI-positive patients being smokers compared to 9.2% of SSI-negative patients. This finding is supported by numerous studies in the literature. Sørensen et al., in their meta-analysis involving 51 studies, reported that current smokers had a 1.79-fold increased risk of SSI compared to non-smokers (pooled OR: 1.79; 95% CI: 1.57-2.04) [135].

Smoking impairs wound healing through several mechanisms, including vasoconstriction leading to tissue hypoxia, inhibition of inflammatory cell migration, reduction in collagen production, and impairment of epithelialization. Additionally, smoking increases the risk of postoperative pulmonary complications, which can further contribute to poor wound healing and infection susceptibility. The importance of smoking cessation prior to elective surgery cannot be overstated, with studies demonstrating that cessation at least 4-8 weeks before surgery significantly reduces the risk of SSI [135].

Interestingly, our study did not find a significant association between alcoholism and SSI (p=0.45). This contrasts with some studies in the literature that have reported alcohol abuse as a risk factor for SSI. Nolan et al. found that alcohol abuse was associated with a 1.9-fold increased risk of SSI following colorectal surgery (adjusted OR: 1.9; 95% CI: 1.1-3.4) [136]. The lack of significant association in our study could be attributed to under reporting of alcohol consumption due to social stigma or differences in the definition and quantification of alcohol abuse.

Types of Surgical Procedures and SSI

Our study included a diverse range of surgical procedures, with cholecystectomy (27.6%), LSCS (23.6%), and hernioplasty (15.6%) being the most common. The distribution of surgical procedures in our study is reflective of the typical case mix in a general surgical unit of a tertiary care hospital. Several studies have demonstrated that the risk of SSI varies significantly depending on the type of surgical procedure. Procedures involving the gastrointestinal tract, which have a higher bacterial burden, typically have higher SSI rates compared to clean procedures like hernioplasty.

In a large multicentre study by Limón et al. involving 7,324 surgical procedures, the SSI rates ranged from 1.7% for clean procedures to 16.3% for dirty and infected procedures [137]. Similarly, the ECDC reported SSI rates ranging from 0.5% for knee prosthesis surgeries to 9.0% for colon surgeries [126]. Our study did not analyse SSI rates by specific surgical procedures, which is a limitation. Future studies should stratify SSI rates by surgical procedure and risk index to enable more meaningful comparisons and targeted interventions.

Wound Classification and SSI

Our study found a significant association between wound classification and SSI ($p<0.001$). Clean-contaminated wounds were the most common (67.6%), followed by contaminated wounds (20.9%), dirty and infected wounds (7.6%), and clean wounds (4%). None of the patients with clean wounds developed SSI, whereas all patients with dirty and infected wounds developed SSI. This finding is consistent with the established relationship between wound classification and SSI risk.

National health safety Network (NHSN 2023) wound classification system has been widely used to predict SSI risk based on the degree of microbial contamination. Clean wounds involve uninfected operative wounds with no inflammation and no entry into the respiratory, alimentary, genital, or urinary tracts. Clean-contaminated wounds involve operative wounds in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Contaminated wounds include open, fresh, accidental wounds or operations with major breaks in sterile technique or gross spillage from the gastrointestinal tract. Dirty and

infected wounds include old traumatic wounds with retained devitalized tissue and wounds involving existing clinical infection or perforated viscera [138].

Our findings align with those of Shah et al., who reported SSI rates of 3.7%, 5.8%, 9.8%, and 21.3% for clean, clean-contaminated, contaminated, and dirty and infected wounds, respectively [125]. Similarly, Aga et al. found SSI rates of 3.6%, 9.2%, 17.5%, and 36.5% for clean, clean-contaminated, contaminated, and dirty and infected wounds, respectively [139]. The progressive increase in SSI rates with increasing levels of wound contamination underscores the importance of appropriate wound classification for risk stratification and targeted preventive measures.

Microbiological Profile of SSI

Causative Organisms

Our study found that Gram-negative bacteria were the predominant causative organisms of SSI, with *E. coli* being the most common isolate (40%), followed by *Staphylococcus aureus* (*MSSA* and *MRSA* combined: 30.6%), and *Klebsiella species* (*K. pneumoniae and K. oxytoca* combined: 20.6%). This distribution of causative organisms is consistent with several studies from developing countries but differs from those reported in developed countries, where Gram-positive bacteria, particularly S. aureus, are typically the predominant pathogens.

A systematic review by Allegranzi et al. analysing SSI data from low- and middle-income countries found that Gram-negative bacteria were responsible for 36-77% of SSIs, with *E. coli* being the most common isolate in most studies [140]. In contrast, data from the NHSN in the United States show that *S. aureus* accounts for approximately 30% of SSIs, followed by *coagulase-negative staphylococci* (11-15%), *Enterococcus species* (8-10%), and *E. coli* (8-10%) [128].

The predominance of Gram-negative bacteria in our study and other studies from developing countries could be attributed to several factors. First, a higher proportion of abdominal surgeries, which have a higher risk of Gram-negative contamination from the gastrointestinal tract, may be performed in these settings. Second, environmental factors, including higher ambient temperatures and humidity, poor sanitation, and overcrowding, favour the growth and transmission of Gram-

negative bacteria. Third, differences in infection control practices, antibiotic usage patterns, and surveillance methods could contribute to this variation.

The high proportion of *E. coli* in our study (40%) is particularly noteworthy and aligns with findings from other studies in similar settings. Saxena et al. reported *E. coli* as the most common isolate (38.4%) in their study on SSIs in a tertiary care hospital in North India [124]. *E. coli* is a common inhabitant of the human intestinal tract and is frequently implicated in infections following abdominal and gynaecological surgeries. The high prevalence of *E. coli* in our study could be attributed to the inclusion of a substantial number of abdominal and gynaecological surgeries (cholecystectomy: 27.6%, LSCS: 23.6%, exploratory laparotomy: 7.1%).

S. aureus was the second most common isolate in our study, accounting for 30.6% of cases (*MSSA*: 20%, *MRSA:* 1-.6%). This finding is consistent with the study by Shah et al., who reported S. aureus as the second most common isolate (26.7%) in their multicentre study on SSIs in India [125]. *S. aureus* is a common skin commensal and is frequently implicated in SSIs following clean surgeries. The ability of *S. aureus* to form biofilms, produce various virulence factors, and develop antibiotic resistance makes it a particularly challenging pathogen to eradicate.

The isolation of methicillin-resistant *S. aureus (MRSA*) in 10.6% of our cases is concerning but lower than the rates reported in some studies. Chaudhary et al. found MRSA in 15.7% of their SSI isolates [127]. *MRSA* infections are associated with increased mortality, prolonged hospitalization, and higher healthcare costs compared to *Methicillin-susceptible S. aureus (MSSA*) infections. The emergence and spread of *MRSA* in healthcare settings worldwide underscore the importance of antimicrobial stewardship and infection control measures.

Klebsiella species were the third most common isolates in our study, accounting for 20.6% of cases (*K. pneumoniae*: 15%, *K. oxytoca*: 5.62%). This finding is consistent with the study by Saxena et al., who reported *Klebsiella species* in 16.2% of their SSI cases [124]. *Klebsiella species* are opportunistic pathogens and are frequently implicated in healthcare-associated infections, including SSIs. The intrinsic resistance

of *Klebsiella species* to certain antibiotics and their ability to acquire additional resistance mechanisms make them challenging to treat.

Pseudomonas aeruginosa was isolated in a relatively small proportion of our cases (4.37%). This contrasts with some studies that have reported higher rates of *P. aeruginosa* in SSIs. Chaudhary et al. found *P. aeruginosa* in 12.6% of their SSI isolates [127]. *P. aeruginosa* is an opportunistic pathogen with intrinsic resistance to many antibiotics and is frequently implicated in healthcare-associated infections, particularly in immunocompromised patients. The relatively low prevalence of *P. aeruginosa* in our study could be attributed to differences in patient populations, surgical procedures, and infection control practices.

It is noteworthy that 25.8% of our suspected SSI cases were culture-negative. This finding is consistent with the study by Chaudhary et al., who reported a culture negativity rate of 31.2% among clinically suspected SSI cases [127]. Culture-negative SSIs could be attributed to several factors, including prior antibiotic therapy, inadequate sample collection, fastidious or anaerobic organisms that may not grow on routine culture media, or non-infectious causes of inflammation at the surgical site.

Antibiotic Resistance Patterns

Our study revealed alarming rates of antibiotic resistance among the isolated pathogens. Gram-negative bacteria, particularly *E. coli* and *Klebsiella species*, showed high resistance to commonly used antibiotics, including penicillins, cephalosporins, and fluoroquinolones. Among Gram-positive bacteria, S. aureus showed high resistance to penicillins and moderate resistance to fluoroquinolones.

For *E. coli* isolates, resistance rates were highest against cephalosporins (66.7%) and fluoroquinolones (77.8%), followed by penicillins (47.6%) and tetracyclines (42.9%). In contrast, *E. coli* showed relatively low resistance to carbapenems (17.5%) and aminoglycosides (31.7%). This finding is consistent with the study by Saxena et al., who reported high resistance of *E. coli* to ceftriaxone (67.6%), ciprofloxacin (71.4%), and amoxicillin-clavulanic acid (51.4%), with relatively lower resistance to imipenem (4.8%) and amikacin (19.0%) [124].

For *Klebsiella species*, resistance rates were highest against cephalosporins (76.0%) and fluoroquinolones (76.0%), followed by penicillins (64.0%) and tetracyclines (64.0%). *Klebsiella species* also showed high resistance to carbapenems (60.0%) and aminoglycosides (60.0%). This finding aligns with the study by Chaudhary et al., who reported high resistance of Klebsiella species to ceftriaxone (78.9%), ciprofloxacin (73.7%), and amoxicillin-clavulanic acid (68.4%), with moderate resistance to imipenem (42.1%) and amikacin (36.8%)[127].

For *Staphylococcus aureus* isolates, resistance rates were highest against penicillins (38.1%) and fluoroquinolones (54.8%), followed by cephalosporins (31.0%) and aminoglycosides (31.0%). *S. aureus* showed relatively low resistance to glycopeptides (14.3%) and linezolid (16.7%). This pattern is consistent with the study by Shah et al., who reported high resistance of S. aureus to penicillin (78.5%), ciprofloxacin (52.3%), and erythromycin (45.2%), with relatively lower resistance to vancomycin (6.2%) and linezolid (4.0%)[125].

The high rates of antibiotic resistance observed in our study are concerning and reflect the global crisis of antimicrobial resistance. Several factors contribute to this phenomenon, including inappropriate antibiotic prescribing, over-the-counter availability of antibiotics without prescription, inadequate infection control practices, and poor compliance with treatment regimens. The emergence of extended-spectrum beta-lactamase (ESBL) producing Enterobacteriaceae, carbapenem-resistant Enterobacteriaceae (CRE), and methicillin-resistant *Staphylococcus aureus (MRSA)* poses significant challenges to clinical management and infection control.

It is noteworthy that resistance to reserve antibiotics like carbapenems, colistin, and tigecycline was relatively low in our study. Imipenem and meropenem showed resistance rates of 24.6% and 25.4%, respectively, while colistin and tigecycline showed resistance rates of 3.4% and 6.9%, respectively. These antibiotics are often considered the last line of defence against multidrug-resistant Gram-negative bacteria, and their judicious use is crucial to preserve their efficacy.

The antibiotic resistance patterns observed in our study have important implications for empirical antibiotic therapy for SSIs. Given the high resistance to commonly used antibiotics like cephalosporins and fluoroquinolones, these agents may

not be suitable for empirical therapy in our setting. Aminoglycosides, which showed relatively lower resistance rates, could be considered for empirical therapy in combination with other agents. Reserve antibiotics like carbapenems should be reserved for documented multidrug-resistant infections or critically ill patients pending culture results.

Types of SSI

Our study classified SSIs based on the NHSN 2023 criteria into superficial incisional, deep incisional, and organ/space infections. The majority of our SSI cases were superficial incisional (72.5%), followed by deep incisional (27.5%), with no cases of organ/space infections. This distribution is consistent with several studies in the literature. Saxena et al. reported a similar distribution, with 68.2% superficial incisional, 25.3% deep incisional, and 6.5% organ/space infections [124].

The predominance of superficial incisional SSIs in our study and others could be attributed to several factors. First, superficial infections are more readily apparent during clinical examination and therefore more likely to be diagnosed. Second, deep incisional and organ/space infections may require advanced imaging techniques for diagnosis, which may not be readily available in all settings. Third, effective antimicrobial prophylaxis may be more successful in preventing deeper infections, leaving superficial infections as the predominant type.

It is noteworthy that we did not observe any organ/space infections in our study. This could be attributed to the types of surgical procedures performed, with a predominance of procedures less likely to result in organ/space infections. Alternatively, there may have been diagnostic limitations in identifying organ/space infections, which often require advanced imaging techniques. Organ/space infections typically have more severe clinical presentations and are associated with higher morbidity and mortality compared to superficial and deep incisional infections.

Prevention Strategies for SSI

Our study evaluated the bundle care or prevention strategies aimed at reducing SSI rates. These strategies are part of a comprehensive SSI bundle implementation and were already in practice at our hospital and included standardized antibiotic

prophylaxis protocols, enhanced preoperative antiseptic bathing, glycaemic control protocols for diabetic patients, hair removal technique modifications, perioperative normothermia maintenance, optimization of timing for prophylactic antibiotics, proper surgical hand preparation and technique, sterile barrier precautions enhancement, and implementation of dedicated wound care teams. In our study a close monitoring of prevention strategies ,training of wound care management team, patient education, modification of risk factors and ensuring implementation of all the strategies in the most impactful way helped getting a good outcome in reducing the SSI rate.

The implementation of evidence-based prevention strategies is crucial for reducing SSI rates. The World Health Organization (WHO) and the CDC have published comprehensive guidelines for the prevention of SSIs, which provide recommendations based on the best available evidence [141, 142]. These guidelines emphasize the importance of a bundle approach to SSI prevention, addressing modifiable risk factors across the preoperative, intraoperative, and postoperative phases.

The comprehensive SSI bundle implemented in our study is consistent with this approach and aligns with recommendations from major guidelines. A systematic review and meta-analysis by Tanner et al. involving 23 studies found that SSI prevention bundles were associated with a 40% reduction in SSI rates (pooled risk ratio: 0.60; 95% CI: 0.50-0.72)[143]. The effectiveness of bundle interventions can be attributed to the synergistic effect of multiple evidence-based strategies targeting different aspects of SSI risk.

Standardized antibiotic prophylaxis protocols ensure that patients receive appropriate antibiotics at the optimal time to prevent SSI. The choice of antibiotic should be based on the expected pathogens for the specific surgical procedure and local antibiotic resistance patterns. The timing of administration is critical, with most guidelines recommending administration within 60 minutes before surgical incision. A meta-analysis by de Jonge et al. found that antibiotic administration within 120 minutes before incision was associated with a lower risk of SSI compared to administration after incision (pooled OR: 0.47; 95% CI: 0.32-0.69) [144].

Enhanced preoperative antiseptic bathing aims to reduce the bacterial burden on the patient's skin before surgery. Chlorhexidine gluconate (CHG) is commonly used for this purpose due to its broad-spectrum activity and residual effect. A meta-analysis by Webster and Osborne involving 20 studies found that preoperative bathing with chlorhexidine was associated with a 9% reduction in SSI rates compared to no bathing or bathing with soap (pooled risk ratio: 0.91; 95% CI: 0.80-1.04), though this difference was not statistically significant [145]. The authors concluded that more high-quality research is needed to definitively establish the effectiveness of preoperative bathing with antiseptics.

Glycaemic control protocols for diabetic patients aim to maintain perioperative blood glucose levels within an optimal range to reduce SSI risk. Hyperglycaemia impairs neutrophil function and wound healing, increasing susceptibility to infection. A systematic review by Martin et al. found that implementation of glycaemic control protocols was associated with a 35% reduction in SSI rates among diabetic patients (pooled risk ratio: 0.65; 95% CI: 0.54-0.78) [146]. The optimal target range for perioperative blood glucose remains debated, with most guidelines recommending levels below 180-200 mg/dL.

Hair removal technique modifications involve avoiding preoperative hair removal when possible or using clippers instead of razors when hair removal is necessary. Razor shaving can cause microscopic cuts in the skin or abrasions creating portals of entry for bacteria. A Cochrane review by Tanner et al. found that hair removal with clippers was associated with a lower risk of SSI compared to razor shaving (risk ratio: 0.55; 95% CI: 0.38-0.79) [147]. The authors concluded that if hair removal is necessary, clippers are preferred over razors, and hair removal should be performed as close to the time of surgery as possible.

Perioperative normothermia maintenance aims to prevent hypothermia, which can impair immune function and reduce tissue oxygenation. A landmark study by Kurz et al. found that maintaining normothermia during colorectal surgery was associated with a 64% reduction in SSI rates (13.0% vs. 19.0%, p=0.001) [148]. Subsequent studies have confirmed this finding, leading to the incorporation of normothermia maintenance into SSI prevention bundles.

Optimization of timing for prophylactic antibiotics ensures that antibiotics are administered at the optimal time to achieve adequate tissue concentrations during surgery. Most guidelines recommend administration within 60 minutes before surgical incision, with exceptions for certain antibiotics like vancomycin and fluoroquinolones, which should be administered 60-120 minutes before incision due to their longer infusion times. A meta-analysis by Steinberg et al. found that antibiotic administration within 60 minutes before incision was associated with the lowest risk of SSI [149].

Proper surgical hand preparation and technique are fundamental aspects of SSI prevention. Surgical hand antisepsis aims to eliminate transient bacteria and reduce resident bacteria on the hands of the surgical team. Both alcohol-based hand rubs and traditional scrubs with chlorhexidine or povidone-iodine are effective for this purpose. A systematic review by Tanner et al. found no significant difference in SSI rates between alcohol-based hand rubs and traditional scrubs (risk ratio: 0.97; 95% CI: 0.77-1.23) [150]. However, alcohol-based hand rubs may be preferred due to their rapid action, less skin irritation, and ease of use.

Sterile barrier precautions enhancement involves measures such as using appropriate surgical attire, double gloving, and using impervious gowns and drapes. These measures aim to reduce the transfer of microorganisms from the surgical team and environment to the patient. A systematic review by Saltzman et al. found that double gloving was associated with a 71% reduction in inner glove perforations compared to single gloving (pooled OR: 0.29; 95% CI: 0.23-0.37) [151]. However, the impact of double gloving on SSI rates remains unclear due to limited evidence.

Implementation of dedicated wound care teams involves establishing specialized teams responsible for wound assessment, dressing changes, and early detection of complications. These teams ensure standardized, evidence-based wound care practices and facilitate early intervention for suspected infections. While there is limited evidence specifically evaluating the impact of dedicated wound care teams on SSI rates, several studies have demonstrated their effectiveness in improving wound healing outcomes and reducing wound complications in various settings.

The implementation of these prevention strategies in our study has likely contributed to maintaining our SSI rate at 4.98%, which is within the acceptable range according to the NHSN benchmark data. However, continuous surveillance, feedback, and quality improvement efforts are essential to further reduce this burden and improve patient outcomes.

Limitations and Future Directions

Our study has some limitations that should be acknowledged. First, the cross-sectional design limits our ability to establish causal relationships between risk factors and SSI development. Second, the inclusion of a diverse range of surgical procedures with varying intrinsic risks makes it challenging to interpret the overall SSI rate without stratification by procedure type and risk index. Third, the follow-up of SSI cases gets difficlut as patient sometimes don't report back after getting discharged and don't respond telephonically potentially missing post-discharge SSIs, which can account for a significant proportion of all SSIs. Fourth, the study carried out the aerobic incubation of cultures in the laboratory, so there chances of missing the anaerobic pathogens among the SSI cases.

Future studies should address these limitations by adopting prospective designs with extended follow-up periods, stratifying SSI rates by procedure type and risk index, and evaluating the impact of individual prevention strategies through controlled interventions. Additionally, research should focus on emerging areas such as the role of the microbiome in SSI development, novel approaches to antibiotic prophylaxis, and innovative technologies for wound surveillance and management.

SUMMARY

Our study examined 3,280 surgical cases, identifying 225 suspected surgical site infections (SSIs) based on clinical symptoms, of which 160 were culture-positive, yielding an overall SSI rate of 4.87%. The majority of patients (49.8%) were in the 20-40 years age group, with a slight female predominance (54.7%) in the study population.

Regarding surgical procedures, cholecystectomy (27.6%), LSCS (23.6%), and hernioplasty (15.6%) were the most frequently performed operations. Clean-contaminated wounds constituted the majority (67.6%) of cases, followed by contaminated wounds (20.9%), dirty and infected wounds (7.6%), and clean wounds (4.0%). A statistically significant association was observed between wound classification and SSI development ($p<0.001$), with all patients having dirty and infected wounds developing SSI, while none with clean wounds developed infection.

The microbiological profile revealed Gram-negative bacteria as predominant pathogens, with *Escherichia coli* being the most common isolate (40%), followed by *Staphylococcus aureus (MSSA* and *MRSA* combined: 30.6%), and *Klebsiella species* (20.6%). Notably, 25.8% of suspected SSI cases were culture-negative. Based on the CDC classification, the majority of SSIs were superficial incisional (72.5%), followed by deep incisional (27.5%), with no cases of organ/space infections.

Antibiotic resistance analysis showed alarming rates of resistance among isolated pathogens. For *E. coli*, resistance was highest against fluoroquinolones (77.8%) and cephalosporins (66.7%), with relatively lower resistance to carbapenems (17.5%). *Klebsiella species* demonstrated high resistance to multiple antibiotic classes, including cephalosporins (76.0%), fluoroquinolones (76.0%), and carbapenems (60.0%). *S. aureus* isolates showed high resistance to fluoroquinolones (54.8%) and penicillins (38.1%), with *MRSA* accounting for 7.6% of all SSI cases.

Several risk factors were significantly associated with SSI development, including Type 2 diabetes mellitus ($p=0.002$), hypertension ($p<0.001$), coronary artery disease ($p=0.05$), COPD ($p=0.005$), anaemia ($p=0.04$), and smoking ($p=0.01$). No

statistically significant association was found between age and SSI (p=0.63) or between alcoholism and SSI (p=0.45).

The close monitoring and of implementation of a comprehensive SSI prevention bundle which is already in practice in the hospital which included standardized antibiotic prophylaxis protocols, enhanced preoperative antiseptic bathing, glycaemic control protocols for diabetic patients, hair removal technique, perioperative normothermia maintenance, optimization of timing for prophylactic antibiotics, proper surgical hand preparation techniques, enhanced sterile barrier precautions, and dedicated wound care teams. These strategies likely contributed to maintaining our SSI rate within acceptable international benchmarks

CONCLUSION

1. In conclusion, our study found an SSI rate of 4.87% in our hospital.
2. *E. coli*, *S. aureus*, and *Klebsiella species* being the predominant causative organisms. Type 2 diabetes mellitus, Hypertension, COPD , Anaemia, and Smoking were identified as significant risk factors for SSI.
3. High levels of antibiotic resistance were observed, particularly to cephalosporins, fluoroquinolones, and penicillins, with relatively lower resistance to carbapenems, aminoglycosides, and reserve antibiotics like colistin and tigecycline.
4. The close monitoring of a comprehensive SSI bundle incorporating evidence-based prevention strategies has likely contributed to maintaining our SSI rate within the acceptable range.
5. These findings have important implications for clinical practice and institutional policies.
6.First, risk stratification based on identified risk factors can help target preventive measures to high-risk patients. Second, the microbiological profile and antibiotic resistance patterns should guide empirical therapy for suspected SSIs in our setting. Third, the implementation of comprehensive prevention bundles should be prioritized to reduce the burden of SSIs.
7.Finally, continuous surveillance and quality improvement efforts are essential to further reduce SSI rates and improve patient outcomes.

Surgical site infections remain a significant challenge in surgical care, with substantial implications for patient outcomes and healthcare costs. A multifaceted approach addressing modifiable risk factors, evidence-based prevention strategies, and rational antimicrobial use is necessary to tackle this challenge effectively. Our study contributes to the existing body of literature on SSIs and provides valuable insights for improving surgical care and infection prevention in similar settings.

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CLNICAL PROFROMA

Name of the Patient:

Age:

Gender:

Occupation:

Date of surgery:

Complaints after the surgery:

History of Present illness:

1. History of fever after surgery:

2. History of pain around surgical wound:

3. History of redness or swelling around the surgical wound:

4. History of any pus discharge:

5. Co-morbidities: Hypertension/Diabetes Mellitus/others

6. Smoker/Non smoker

7. Drinker/ Non Drinker

Past history:

Family history:

Treatment history:

General Examination:

CLINICAL DIAGNOSIS

FORM OF INFORMED CONSENT

I _____S/d/w of _____a resident of _____ hereby declare that I give informed consent to participate in the thesis study titled "**STUDY OF RATE, MICROBIOLOGICAL PROFILE AND RISK FACTORS OF SURGICAL SITE INFECTIONS, EVALUATING IMPACT OF PREVENTION STRATEGIES**" and I have been told in the language I understand that this study involves, detailed History, general examination and follow up after my surgical procedure, I may need some investigations for the study.

I understand that my participation in this study is confidential and that no material that could identify me will be used in the analysis and in any reports based on this study.

I give full consent for being enrolled in the above study and I reserve my rights to withdraw from the study whenever I wish without prejudice of my right to undergo further treatment at Santosh Medical College and hospital, Ghaziabad.

Name of Subject Date Signature of subject

We have witnessed that the patient signed the above form in the presence of his/her free will after fully having understood its contents.

Name of Witness Date Signature of witness

Name of Investigator Date Signature of Investigator

सहमति पत्र

दिनांक–

मैं ..... उम्र ..... निवासी .... घोषणा करता/करती हूँ कि मैं थीसिस अध्ययन में भाग लेने के लिए अपनी सहमति देता/देती हूँ , जिसका शीर्षक है "सर्जिकल साइट संक्रमणों के सूक्ष्मजैविक प्रोफाइल और जोखिम कारकों का अध्ययन, निवारक रणनीतियों के प्रभाव का मूल्यांकन".मैंनें रोगी सूचना पत्र और इसके बारे में सारे प्रश्नों को अच्छी तरह पढ़ लिया है। इस अध्ययन का डाटा इस शर्त पर है कि मेरे सभी विवरण गोपनीय रखे जाने हैं।

मैं संतोष अस्पताल, गाजियाबाद उ0प्र0 में अपने आगे के इलाज का का अधिकारी तथा जब भी मैं जाना चाहता/चाहती हूँ या अध्ययन से अपने हटने के अधिकार को सुरक्षित रखता हूँ।

मरीज के हस्ताक्षर नाम

रिश्तेदार के हस्ताक्षर नाम

गवाह के हस्ताक्षर नाम

डाक्टर के हस्ताक्षर नाम

तिथि –

ETHICAL CLEARANCE

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F. No. SU/R/2023/2489[19] Dated: 26.09.2023

Subject: Grant of Ethical Clearance for **Thesis Protocol** Topic **"STUDY OF RATE , MICROBIOLOGICAL PROFILE AND RISK FACTORS OF SURGICAL SITE INFECTIONS AND EVALUATING IMPACT OF PREVENTION STRATEGIES"**, submitted by **Dr. JAGDEEPAK GILL,** MD/MS student of Batch 2022-2023, Department of **MICROBIOLOGY**.

*****

With reference to his/her request for grant of Ethical Clearance for the Thesis Protocol entitled **"STUDY OF RATE , MICROBIOLOGICAL PROFILE AND RISK FACTORS OF SURGICAL SITE INFECTIONS AND EVALUATING IMPACT OF PREVENTION STRATEGIES", Dr. JAGDEEPAK GILL** is informed that the **Thesis Protocol** submitted by him/her was considered by the **Screening Committee** of the Santosh Medical College & Hospital in its meetings held on 17.07.2023 to 28.07.2023. The recommendations of the **Screening Committee** were considered in detail by the **Institutional Ethics Committee** in its meeting held on **23.09.2023** and the same was **approved** by the **Ethics Committee.**

He /She is informed accordingly for further necessary action.

[Dr. NARESH SHARMA]
REGISTRAR

SANTOSH "DEEMED TO BE UNIVERSITY" REGISTRAR GHAZIABAD, NCR UTTAR

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MASTER CHART

Age	Gender	Risk Factors	Smoker+1:2	Alcohlic	Department	Type of Surgery	Days of Hospital Admission	Grading of Wound	Causative Micro organism	Antibiotic Susceptibility Test
35 yr	Male	No Co - Morbidities	No	yes	General Surgery/ Critical Care	Exploratory Laprotomy	7-14 d 14 days	Dirty/ Infected	Staphylococcus Aureus (MRSA)	**Sensitive--**COT, AK, VA, TE,DO,LZ, TGC, **Resistant--** Ceftriaxone,TOB, Cephelexin, Lincomycin, Cloxacillin, Ampicillin/Sulbactam, cefoperazone/Sulbactam, Cefepime, RO, CIP, OF, LE, GEN
48 yr	Male	A case of Hypertension	Yes	No	General Surgery	Hernioplasty	7-14 days 10 days	Clean Contaminated	Citrobacter Baumanii	**Sensitive**- LE **Resistant**- AS, BA, CF, TZP, CH,CP, CR, CTZ, GM, AK, OF, IPM, MRP, NX, CFM, CAS, CXM,Ceftazidime/clauvinic acid
24 yr	Female	Anaemia with Obstetric Risks	No	No	Obstetrics& Gynaecology	Lower Segement Caesarian section	6 days	Clean Contaminted	Citrobacter Koseri	**Sensitive**- CL,TE Intermediate- AK, CH **Resistant-** AS, OF, BA, CF, LE, TZP, CP, CR, GEN, AMC, IPM, MRP, CFS
36 yr	Male	Chronic kidney disease with Anaemia	Yes	yes	General Surgery	Fistulectomy	<7 d 5 days	Dirty/ Infected	Citrobacter Koseri	**Sensitive**- PIP/TZ,IMP, Amoxycillin/Clavunic Acid. **Resisitant**- COT, AS, Cefuroxime, cefotaxime, ceftazidime, CIP, OF, LE, TOB, TE
29 yr	Female	Anaemia	No	No	Obstetrics & Gynaecology	Emergency Lower segment ceasarian	7-14 d 10 days	Clean Contaminated	Escherichia Coli	**Sensitive** - Ampicillin/Sulbactam, PIP/TZ, IMP, MRP, Chloramphenicol, Colistin, Ceftriaxone, **Resistant**- Cotrimoxazole, Cefotaxime, Cefipime,CIP, OF, LE, GEN, TE
23 yr	Female	Anaemia	No	No	Obstetrics & Gynaecology	Lower Segement Caesarian section	<7 d 5 days	Clean Contaminated	Escherichia coli	**Sensitive**- PIP/TZ, IMP, MRP, LE, GEN, AK, TOB, COT, FO, Ertapenam. **Resistant**- Amoxycillin/Clavunic Acid, AS,TE, Cefoxitin, Ceftazidime, OF, Cefoperazone/sulbactam
26 yr	Female	Anaemia	No	No	Obstetrics& Gynaecology	Ruptured Ectopic Pregnancy	> 14 days15 days	Clean Contaminated	Escherichia Coli	**Sensitive**- IPM, MRP,CTX, CFS, AMC, AS, BA, LE, TZP, CH, AK, GEN, TE **Resistant**- CR, CIP, OF CF
48 yr	Female	Anaemia No Co - Morbidities	NO	NO	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Escherichia coli	**Sensitive**- AMC, PIP/TZ, IPM, MRP, AK, TOB, Polymyxin B, COL, ETM, TGC, LE **Resistant**- GEN, COT, Ceftriaxone, COT, CIP
21 yr	Male	Anaemia No Co- Morbidities	Yes	yes	General Surgery	Appendectomy	7-14 d 10 days	Contaminated	Escherichia Coli	**Sensitive**- PIP/TZ, MRP, AK, COL, Ertapenam **Resistant-** ceftriaxone, CIP, MO, OF, GEN, IPM, COT, Amoxy/Clauvunic Acid,
58 yr	Male	A Case of Type -2 Diabetes Mellitus	Yes	No	General Surgery/Critical Care	Exploratory Laprotomy	7-14 d 10 days	Dirty/Infected	Escherichia Coli	**Sensitive-** IMP, MRP, Chloramphenicol, Colistin, **Resistant**- COT, Ampi/Sulbactam, PIP/TZ, Ceftriaxone, Cefotaxime,Cefepime,CIP, Norfloxacin, GEN, AK,TOB, TE
29 yr	Female	Anaemia with Obstetric Risks	No	No	Obstetrics& Gynaecology	Emergency Lower Segment Caesarian Section	7 days	Clean Contaminated	Escherichia Coli	**Sensitive**- AK, GEN, IPM, MRP, CL Intermediate- AMC, CFS, TZP. **Resistant**- AS, OF, BA, CF, CH, CP, CR, TE
32 yr	Female	Anemia with no other CO-Morbidities	No	No	Obstetrics & Gynaecology	Lower Segement Caesarian section	<7 d 7 days	Clean Contaminated	Escherichia Coli	**Sensitive**- CH, TE, CL Intermediate- IPM, AMC **Resistant**- AS, OF, BA, LF, LE, TZP, AK, CP, CR, GEN, CFM, CTX, CFS
42 yr	Male	Bronchial Asthma	No	yes	General Surgery -ICU	K/C/O Enteric Fever with ileal perforation with secondary suturing of ileal perforation	> 14 d 22 days	Contaminated	Escherichia Coli	**Sensitive**- PIP/TZ,IMP, MRP, GEN, AK, POLYMYXIN B, Ceftriaxone. **Resisitant**- COT, Amoxy/Clavunic Acid, Ampi/Sulbactam, TE, CH, Cefuroxime, Cefotaxime, Ceftazidime, CIP, OF
39 yr	Female	Bronchial Asthma with anaemia	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Escherichia coli	**Sensitive**- PIP/TZ, IMP, MRP, LE, GEN, AK, TOB, COT, FO, Ertapenam **Resistant-** Amoxycillin/Clavunic Acid, AS,TE, Cefoxitin, Ceftazidime, OF, Cefoperazone/sulbactam
60 yr	Male	CAD, Hypertension with Anaemia	No	yes	General Surgery	Cholecystectomy	7-14 d 8 days	Clean Contaminated	Escherichia Coli	**Sensitive**- PIP/TZ, IMP, MRP,GEN, AK, CH **Resistant**- COT, Amoxycillin/Clavunic Acid, AS, TOB, Cefuroxime, Cefotaxime, CIP
65 yr	Male	CAD ,Hypertension with Anaemia	No	Yes	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	Escherichia Coli	**Sensitive**- PIP/TZ, MRP, AK, COL, Ertapenam **Resistant-** ceftriaxone, CIP, MO, OF, GEN, IPM, COT, Amoxy/Clauvunic Acid,
70 yr	Female	CAD with Type-2 DM with Anaemia	No	No	General Surgery	Hernioplasty	< 7 d 3 days	Clean Contaminated	Escherichia Coli	**Sensitive--** Ampicillin/Sulbactam, PIP/TZ, IMP,Ceftriaxone, Cefotaxime, Cefoperazone/Sulbactam, Gen, AK, TOB, Fosfomycin, COL **Resistant**---COT, TE, CHLORPHENICOL, CIP, OF,LE, Ceftazidime
65 yr	Female	CKD with Hypertension with Anaemia	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Escherichia Coli	**Sensitive**- Amoxycillin/Clavunic Acid, Ampi/Sulbactam, Piperacillin/Sulbactam **Resistant**-- IMP, MRP, LE, GEN, AK, CH, Ceftriaxone, COT, TOB, TE
56 yr	Male	CKD with Hypertension	NO	yes	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	Escherichia coli	**Sensitive**- Amoxycillin/Clavunic Acid, Ampi/Sulbactam, Piperacillin/Sulbactam, IMP, MRP, LE, GEN, AK, CH, Ceftriaxone, COT TOB, TE
45 yr	Male	COPD	No	yes	General Surgery	Cholecystectomy	7-14 d 8 days	Clean Contaminated	Escherichia Coli	**Sensitive**- OF, BA, CF, LF, TZP, CH,AK,CP, CR, GM, TE, CFM,CFS, IPM, MRP, AMC, CL. **Resistant**- AS
58 yr	Male	COPD with Hypertension	Yes	yes	General Surgery	Hernioplasty	< 7 d 3 days	Clean Contaminated	Escherichia Coli	**Sensitive**- COT, PIP/TZ, IMP, CIP, LE, AK, DO, Ceftriaxone. **Resistant**- FO, TE, Cefoxitin, Ampicillin/Sulbactam
62 yr	Male	COPD withType -2 Diabetes Mellitus	No	No	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	Escherichia Coli	**Sensitive**- COT, PIP/TZ, IMP, CIP, LE, AK, DO, Ceftriaxone **Resistant**- FO, TE, Cefoxitin, Ampicillin/Sulbactam
58 yr	Male	COPD, Hypertension with Type -2 Diabetes Mellitus	Yes	yes	General Surgery	Hernioplasty	< 7 d 3 days	Clean Contaminated	Escherichia coli	**Sensitive**- GEN, AK, TOB, CH, FO **Resistant**- Ertapenam, Ceftriaxone, TE, COT, Amoxy/Clavunic Acid, AS, PIP/TZ, IMP, Cefttriaxone
85 yr	Male	COPD, Hypertension with Type -2 Diabetes with Anaemia	Yes	No	Orthopaedics	Total Hip Replacement	> 14 d 22 days	Dirty/ Infected	Escherichia Coli	**Sensitive**- CIP, OF, LE, GEN, AK, TOB, PIP/TZ, IMP, MRP, Amoxycillin/Clavunic, FO, Ertapenam **Resistant**- Ceftriaxone, Ampicillin/Sulbactam, Cefalexin, TE, CH, COT

66 yr	Male	COPD,Hypertension with Type -2 Diabetes Mellitus Anaemia	yes	yes	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	Escherichia Coli	**SENSITIVE--** GEN,AK, TOB, TE, Chloramphenicol, FO, COL **RESISTANT--** COT, Ampicillin/Sulbactam, PIP/TZ, IMP,MRP, Ceftriaxone, Cefepime, CIP, OF, LE
75yr	Male	Coronary artery disease with Hypertension, DM	Yes	No	General Surgery	Hernioplasty	< 7 d 3 days	Clean Contaminated	Escherichia coli	**Sensitive**- IMP, MRP, GEN, AK, TE, TGC, COT **Resistant**- Amoxy/Clauv, Ceftriaxone, CIP, LE, Benzylpenicillin
63 yr	Female	CAD with Diabetes Mellitus	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive**- PIP/TZ, Cefotaxime, RX, DO, LZ, Lincomycin, TGC, TOB **Resistant** - GE, VAN, TE, Clotrimazole, Cephalexin, CIP, Cefoxitin, Cefixime
49 yr	Female	Anaemia with no Co- Morbidities	No	No	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Escherichia coli	**Sensitive**- AMC, PIP/TZ, IPM, MRP, AK, Chloramphenicol, COL, ETM, **Resistant**- Ceftriaxone, COT, Cefotaxime, CIP, LE, GEN
42 yr	Female	Diabetes mellitus	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Escherichia Coli	**Sensitve**- MRP, LE, TE, CH, AK, **Resistant**- Ceftriaxone, GEN, COT, Ampilicillin/Sulbactam, PIP/TZ, Cefotaxime, CIP, OF
40 yr	Female	Anaemia	No	No	General Surgery	Open Cholecystectomy	<7 d 5 days	Clean Contaminated	Escherichia coli	**Sensitive**-LE, GEN, AK, Polymyxin B, Colistin, Ertapenam, TGC, PIP/TZ, IMP, MRP **Resistant**- Ciprofloxacin, COT, Amoxy/Clavunic acid, Ceftriaxone
50 yr	Male	Diabetes mellitus	No	No	General Surgery	Exploratory Laparotomy	7-14 d 14 days	Contaminated	Escherichia Coli	**Sensitive**- IPM, MRP,CTX, CFS, AMC, AS, BA, LE, TZP, CH, AK, GEN, TE. **Resistant**- CR, CIP, OF CF
58 yr	Male	Hypertension	Yes	No	General Surgery/Critical Care	Exploratory Laprotomy	7-14 d 12 days	Dirty/Infected	Escherichia Coli	**Sensitive**- IMP, MRP, Chloramphenicol, Fosfomycin, Colistin, **Resistant**- COT, Ampi/Sulbactam, PIP/TZ, Ceftriaxone, Cefotaxime,Cefepime,CIP, Norfloxacin, GEN, AK,TOB, TE
70 yr	Female	Diabetes mellitus	No	No	Orthopaedics	Open reduction with internal Fixation both bone left arm	<7 d 7 days	Contaminated	Escherichia coli	**Sensitive**- AMC, PIP/TZ, IPM, MRP, AK, TOB, Polymyxin B, COL, ETM, TGC, LE **Resistant**- GEN, COT, Ceftriaxone, COT, CIP
58 yr	Male	Diabetes mellitus	No	No	General Surgery	cholecystectomy	7-14 d 12 days	Clean Contaminated	klebsiella Pneumoniae	**Sensitive-** Cefoperazone/Sulbactam, GEN, AK, Chloramphenicol, Polymyxin B, **Resistant --**FO,TE,Cefepime, CIP,Norfloxacin, Ofloxacin,LE, COT, Ampicillin/Sulbactam, PIP/TZ, MRP Ceftriaxone Ceftriaxone
37 yr	Male	A case of Hypertension	Yes	No	General Surgery	Open appendectomy	7-14 d 14 days	Contaminated	Escherichia Coli	**Sensitive**- PIP/TZ, IPM, MRP, GEN,AK **Resistant**- ceftriaxone, TE, COT, Amoxycillin/Clavunic Acid ,AS, Cefixime,Ceftazidime, CIP, OF
31yr	Female	Anemia	No	No	Obstetrics & Gynaecology	Lower segment caesarian section	< 7 d 3 days	Clean Contaminated	Escherichia coli	**Sensitive-** PIP/TZ, IMP, MRP, LE, GEN, AK, TOB, COT, FO, Ertapenam. **Resistant**- Amoxycillin/Clavunic Acid, AS,TE, Cefoxitin, Ceftazidime, OF, Cefoperazone/sulbactam
45 yr	Female	Hypertension With Anemia	No	No	General Surgery	Open Cholecystectomy	14 days	Clean Contaminated	Escherichia Coli	**Sensitive**- CIP, OF, LE, GE, AK, TE, CH,PIP/TZ, IMP, MRP, COT, Amoxycillin/Clavunic Acid **Resistant**- Ampicilin/Sulbactam, Cefuroxime, Ceftriaxone, Ceftazidime
63 yr	Male	Hypertension with COPD	Yes	No	General Surgery	Cholecystectomy	<7 d 7 days	Clean Contaminated	Escherichia coli	**Sensitive**- AMC, AS, PIP/TZ, IMP, Cefperazone/Sulbactam, Cefipime, GEN, AK **Resistant**- TE, COT, OF
60 yr	Male	A case of Hypertension	Yes	No	General Surgery	Open Cholecystectomy with CBD Exploration with Stent Exploration	> 14 days15 days	Contaminated	Escherichia Coli	**Sensitve**- MRP, LE, TE, CH, AK, **Resistant**- Ceftriaxone, GEN, COT, Ampilicillin/Sulbactam, PIP/TZ, Cefotaxime, CIP, OF
70 yr	Male	Type-2 Diabetes mellitus with COPD	No	No	General Surgery	Open Hernioplasty	<7 d 5 days	Clean Contaminated	Escherichia coli	**Sensitive**- PIP/TZ, IMP, MRP, LE, GEN, AK, TOB, COT, FO, Ertapenam. **Resistant**- Amoxycillin/Clavunic Acid, AS,TE, Cefoxitin, Ceftazidime, OF, Cefoperazone/sulbactam
34 yr	Male	Anaemia No Co- Morbidities	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Escherichia Coli	**Sensitive-** LE, Chloramphenicol. **Resistant-** Ceftriaxone, TOB, GEN, AK, TE, COT, Ampi/Sulbactam, Ceefotaxime, Cefipime, Ciprofloxacin, Norfloxacin, Ofloxacin, IMP, MRP
44 yr	Female	No Co - Morbidities	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Escherichia coli	**Sensitive**- COT, GEN, COL, TGC, **Resistant**- Ceftriaxone, Cefuroxime/ Axetil, Ertapenam, TE, chloramphenicol, Amoxy/Clauv, PIP/TZ, IMP, MRP, Cefipime
32 yr	Male	No Co - Morbidities	NO	Yes	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Escherichia Coli	**Sensitive** - Ampicillin/Sulbactam, PIP/TZ, IMP, MRP, Chloramphenicol, Colistin, Ceftriaxone, **Resistant**- Cotrimoxazole, Cefotaxime, Cefipime,CIP, OF, LE, GEN, TE
35 yr	male	No Co - Morbidities	no	yes	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Escherichia Coli	**Sensitive**- PIP/TZ, IMP, MRP,GEN, AK, CH **Resistant**- COT, Amoxycillin/Clavunic Acid, AS, TOB, Cefuroxime, Cefotaxime, CIP
25 yr	Male	No Co- Morbidities	Yes	No	General Surgery	Haemorrhoidectomy	7-14 d 12 days	Clean contaminated	Escherichia Coli	**Sensitive**- AK, GEN, IPM, MRP, CL Intermediate- AMC, CFS, TZP. **Resistant**- AS, OF, BA, CF, CH, CP, CR, TE
26 yr	Male	No Co- Morbidities	No	No	General Surgery	Appendicectomy	<7 d 7 days	Contaminated	Escherichia coli	**Sensitive**- PIP/TZ, IMP, MRP, LE, GEN, AK, TOB, COT, FO, Ertapenam **Resistant-** Amoxycillin/Clavunic Acid, AS,TE, Cefoxitin, Ceftazidime, OF, Cefoperazone/sulbactam
18 yr	Male	No Co- Morbidities	No	NO	General Surgery	Appendicectomy	7-14 d 14 days	Contaminated	Escherichia Coli	**Sensitive**- GEN,Amikacin, Chloraphenicol, Colistin **Resistant -** TOB, TE, COT, AMPI/SULBACTAM, PIP/TZ, MRP, Ceftriaxone, Cefipime, CIP, NO, OF, LE
18 y	Male	No Co- Morbidities	No	No	Critical Care	Exploratory Leprotomy	<7 d 7 days	Dirty/ Infected	Escherichia coli	**Sensitive**- COT, Amoxy/ Clavunic Acid, PIP/TZ, GEN, AK, CH, Ertapenam, TGC, Ceftriaxone, Cefperazone/Sulbactam, Cefipime. **Resistant**- CIP, Cefotaxime
24 yr	Male	No Co- Morbidities	Yes	NO	General Surgery	Fistulectomy	<7 d 5 days	Dirty/ Infected	Escherichia Coli	**Sesitive**- AMC, PIT, IPM, MRP, CM, CF, TZP, CH ,AK, CP, CR, CFM, TE, AS **Resistant-** AP, NIT, BA , OF, LE
19 yr	Male	No Co- Morbidities	Yes	yes	General Surgery	Fistulectomy	< 7 d 3 days	Dirty/ Infected	Escherichia Coli	**Sensitive**- PIP/TZ, IMP, MRP,GEN, AK, CH **Resistant**- COT, Amoxycillin/Clavunic Acid, AS, TOB, Cefuroxime, Cefotaxime, CIP
31 yr	Male	No Co- Morbidities	No	NO	General Surgery	Hernioplasty	7-14 d 12 days	Clean Contaminated	Escherichia Coli	**Sensitive**- CIP, OF, LE, GE, AK, TE, CH,PIP/TZ, IMP, MRP, COT, Amoxycillin/Clavunic Acid **Resistant**- Ampicilin/Sulbactam, Cefuroxime, Ceftriaxone, Ceftazidime
30 yr	Male	No Co- Morbidities	No	yes	General Surgery	Intestinal Perforation Emergency Exploratory Laprotomy	7-14d 14 days	Contaminated	Escherichia Coli	**Sensitive**- GEN,Amikacin, Chloraphenicol, Colistin **Resistant -** TOB, TE, COT, AMPI/SULBACTAM, PIP/TZ, MRP, Ceftriaxone, Cefipime, CIP, NO, OF, LE

31 yr	Female	No Co- Morbidities	No	No	Obstetrics & Gynaecology	Lower segment caesarian section	< 7 d 3 days	Clean Contaminated	Escherichia coli	**Sensitive**- PIP/TZ, IMP, MRP, LE, GEN, AK, TOB, COT, FO, Ertapenam**. Resistant**- Amoxycillin/Clavunic Acid, AS,TE, Cefoxitin, Ceftazidime, OF, Cefoperazone/sulbactam
28 yr	Female	No Co- Morbidities	No	No	Obstetrics & Gynaecology	Lower segment caesarian section	< 7 d 3 days	Clean Contaminated	Escherichia coli	**Sensitive**- PIP/TZ, IMP, MRP, Ceftazidime, AZ, AK, TOB, Polymyxin B, COL
11 yr	Female	No Co- Morbidities	No	No	ENT	Tonsillectomy	< 7 d 3 days	Contaminated	Escherichia Coli	**Sensitive**- IPM, MRP,CTX, CFS, AMC, AS, BA, LE, TZP, CH, AK, GEN, TE **Resistant**- CR, CIP, OF CF
24 yr	Female	Obstetric Risks	No	No	Obstetrics & Gynaecology	Emergency Lower segment caesarian section	7-14 d 10 days	Clean Contaminated	Escherichia coli	**Sensitive**-LE, GEN, AK, Polymyxin B, Colistin, Ertapenam, TGC, PIP/TZ, IMP, MRP **Resistant**- Ciprofloxacin, COT, Amoxy/Clavunic acid, Ceftriaxone
36 yr	Female	Obstetric Risks	No	No	Obstetrics & Gynaecology	Lower Segement Caesarian section	7-14 d 14 days	Clean Contaminated	Escherichia Coli	**Sensitive**- CH, TE, CL Intermediate- IPM, AMC **Resistant**- AS, OF, BA, LF, LE, TZP, AK, CP, CR, GEN, CFM, CTX, CFS
26 yr	Female	Obstetric Risks	No	No	Obstetrics & Gynaecology	Lower Segment Caesarian section	7-14 days 10 days	Clean contaminated	Escherichia Coli	**Sensitive**- IPM, MRP,CTX, CFS, AMC, AS, BA, LE, TZP, CH, AK, GEN, TE **Resistant**- CR, CIP, OF CF
25 yr	Female	Obstetric Risks	No	No	Obstetrics & Gynaecology	Lower segment caesarian section	<7 d 5 days	Clean Contaminated	Escherichia coli	**Sensitive**- Amoxycillin/Clavunic Acid, Ampi/Sulbactam, Piperacillin/Sulbactam, IMP, MRP, LE, GEN, AK, CH, Ceftriaxone, COT TOB, TE
37 yr	Female	Obstetric Risks	No	No	Obstetrics & Gynaecology	Lower segment ceasarian	< 7 d 3 days	Clean Contaminated	Escherichia coli	**Sensitive**- PIP/TZ, IMP, MRP, LE, GEN, AK, TOB, COT, FO, Ertapenam **Resistant-** Amoxycillin/Clavunic Acid, AS,TE, Cefoxitin, Ceftazidime, OF, Cefoperazone/sulbactam
27 y	Female	obstetric risks with Anemia	No	No	Obstetrics & Gynaecology	Emergency Lower segment ceasarian	7-14 d 14 days	Clean Contaminated	Escherichia coli	**Sensitive**-PIP/TZ, GEN, AK, Ertpenam, TGC, Cefperazone/Sulbactam **Resistant**- Cefipime, CIP, Ceftriaxone, Cefotaxime
32 yr	Female	obstetric RisksNo other Co-Morbidities	No	No	Obstetrics & Gynaecology	Lower segment caesarian section	< 7 d 3 days	Clean Contaminated	Escherichia coli	**Sensitive-** PIP/TZ, IMP, MRP, LE, GEN, AK, TOB, COT, FO, Ertapenam**. Resistant-** Amoxycillin/Clavunic Acid, AS,TE, Cefoxitin, Ceftazidime, OF, Cefoperazone/sulbactam
34 yr	Female	obstetric Risks with Anaemia	No	No	Obstetrics& Gynaecology	Emergency LSCS With Wound Gaping	>14 days 16 days	Clean Contaminated	Escherichia Coli	**Sensitive**- IPM, MRP,CTX, CFS, AMC, AS, BA, LE, TZP, CH, AK, GEN, TE **Resistant**- CR, CIP, OF CF
26 yr	Female	Obsttetric Risks No co-morbidities	No	No	Obstetrics & Gynaecology	Emergency Lower segment caesarian section	7-14 d 10 days	Clean Contaminated	Escherichia coli	**Sensitive**- PIP/TZ, IMP, MRP, LE, GEN, AK, TOB, COT, FO, Ertapenam **Resistant**- Amoxycillin/Clavunic Acid, AS,TE, Cefoxitin, Ceftazidime, OF, Cefoperazone/sulbactam
32 yr	Female	No Co - Morbidities	No	No	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Escherichia Coli	**Sensitive**- PIP/TZ, IPM, MRP, GEN,AK **Resistant**- ceftriaxone, TE, COT, Amoxycillin/Clavunic Acid ,AS, Cefixime,Ceftazidime, CIP, OF
56 yr	Female	Diabetes Mellitus with Anaemia	NO	NO	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Escherichia Coli	**Sensitive--**COT,Amoxicillin, Ampicillin/Sulbactam, PIP/TZ,IMP, MRP, Ceftrixone, Cefperazone/Sulbactam, Cefipime, CIP, OF, LE,GEN,AK,TE,Chloramphenicol, COL **RESISTANT--**Cefotaxime
45 yr	Male	Diabetes Mellitus with Anaemia	No	NO	General Surgery	Fistulectomy	< 7 d 3 days	Contaminated	klebsiella Pneumoniae	**Sensitive**- LE, COL **Resistant**- GEN, AK, TOB, TE, CH, COT, Amoxycillin/Clavunic Acid, Ampi/Sulbactam, PIP/TZ IMP, MRP, Cefalexin, Cefuroxime, Ceftazidime, CIP,
44 y	Female	Diabetes Mellitus with Anaemia	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	klebsiella Pneumoniae	**Sensitive**- Amoxycillin/Clavunic Acid, PIP/TZ, IMP,MRP, Cefoperazone/Sulbactam, Cefipime, CIP, Gen, Ertapenam, Ceftriaxone. **Resistant**- CO, Cefuroxime, axetil
31 yr	Female	A Case of Anaemia	No	No	Obstetrics& Gynaecology	Lower Segement Caesarian section	7-14 d 12 days	Clean Contaminted	Klebsiella oxytoca	**Sensitive**- CH,TE,PIT**. Resistant**-AK,CP,CR,GM,AS,OF,BA,CF,LE,IPM,CPM,MRP,AMC,FO
20 yr	Female	Foetal distress with Anaemia	No	No	Obstetrics& Gynaecology	Emergency LSCS	> 14 days 16 days	Clean Contaminated	Klebsiella oxytoca	**Sensitive**- CH, IPM, MRP,FO **Resistant**- NIT, CTX, AMC, TE, AS , OF, BA, CF, LE, CP, CR, GM
50 yr	Male	Diabetes Mellitus with Anaemia	Yes	yes	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Pesudomonas Aeruginosa	**Sensitive**- Ceftazidime, Cefipime, AK, TOB,Choramphenicol, polymyxin B **Resistant**- Ceftriaxone, CIP, OF, LE, GEN, COT
18 y	Female	No Co - Morbidities	No	No	General Surgery	Appendicectomy	<7 d 5 days	Contaminated	Klebsiella oxytoca	**Sensitive**- COT, AMC, PIP/TZ, IMP, MRP, CTX, Cefperazone/Sulbactam, CIP, OF, LE, GEN, AK, Chloramphenicol Polymyxin B, COL, ETM, TGC, CN, Benzylpenicillin
25 yr	Male	No Co- Morbidities	No	yes	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	Klebsiella oxytoca	**Sensitive**- TE, FO, **Resistant**- Ceftriaxone, CH, COT, Amoxycillin/Clavunic acid, AS, PIP/TZ IMP, Cefotaxime, Ceftazidime, CIP,OF, LE, GE, AK
39 yr	Male	No Co- Morbidities	Yes	No	General Surgery	Hernioplasty	< 7 d 3 days	Clean Contaminated	Klebsiella oxytoca	**Sensitive**- LE, CH, COL Intermediate- OF **Resistant**- GEN, AK, TOB, TE, COT, Amoxycillin/Clavunic Acid, Ampicillin/Sulbactam, PIP/TZ , IMP, MRP, Cefalexin, CIP
24 yr	Female	No Co- Morbidities	No	No	General Surgery	Right Breast Lumpectomy	< 7 d 3 days	Contaminated	Klebsiella oxytoca	**Sensitive**- PIP/TZ, MRP, Ceftazidime, **Resistant**- Ceftriaxone, cefoperazone/Sulbactam, Cefipime, COT, CIP AMC, GEN, Cefuroxime, AK, TE, COL, ETM, TGC
24 yr	Female	Obstetric Risks	No	No	Obstetrics & Gynaecology	Lower segment caesarian section	<7 d 5 days	Clean Contaminated	Klebsiella oxytoca	**Sensitive**- PIP/TZ, MRP, Ceftazidime, **Resistant**- Ceftriaxone, cefoperazone/Sulbactam, Cefipime, COT, CIP AMC, GEN, Cefuroxime, AK, TE, COL, ETM, TGC
21 yr	Male	Trauma with Multiple injuries	YES	YES	General Surgery -ICU	Exploratory Leprotomy	7-14 d 14 days	Dirty And Infected	Klebsiella oxytoca	**Intermediate**- CIP. **Resistan**t- CXS,CTX, GEN, SPX,CAZ,IPM,CFR,LOM,CTR,AK,AS,NET,CPZ,MRP,MO
30 yr	Female	Anaemia with no Co- Morbidities	No	No	General Surgery	Hernioplasty	< 7 d 3 days	Clean Contaminated	klebsiella Pneumoniae	**Sensitive**- OF, LE, **Resistant**- GE, AK, TOB, TE, CH, FO, Cefuroxime, Ertapenam, COT, Ampicillin/Sulbactam, PIP/TZ, MRP, Cefalexin, Ceftazidime, CIP
25 yr	Male	No Co- Morbidities	No	NO	General Surgery	Emergency diagnostic laparotomy	7-14 d 10 days	Dirty/ Infected	klebsiella Pneumoniae	**Sensitive**- Ceftriaxone,COT, Amoxy/Clavunic Acid, AS, PIP/TZ, IMP, Cefotaxime, Ceftriaxone,CIP, OF, LE, GEN, AK, TE, CH
56 yr	Male	CAD with Type-2 DM	No	Yes	General Surgery	Hernioplasty	< 7 d 3 days	Clean Contaminated	klebsiella Pneumoniae	**Sensitive**- PIP/TZ, IPM, MRP, LE, GEN, CH **Resistan**t- AS
59 yr	Female	Chronic kidney disease with Hypertension	No	No	General Surgery	cholecystectomy	<7 d 5 days	Clean Contaminated	Klebsiella pneumoniae	**Sensitive**- TE, TGC, Ceftriaxone, Ertapenem, COT, Amoxy/Clauv, PIP/TZ IMP, MRP Cefixime, CIP, Cefipime, Cefperazone/Sulbactam
79 yr	Male	Type -2 Diabetes Mellitus with COPD	Yes	No	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	Escherichia coli	**Sensitive**- Amoxycillin/Clavunic Acid, Ampi/Sulbactam, Piperacillin/Sulbactam, IMP, MRP, LE, GEN, AK, CH, Ceftriaxone, COT TOB, TE

52 yr	Male	COPD with Hypertension	Yes	NO	General Surgery	Fistulectomy	<7 d 5 days	Contaminated	klebsiella Pneumoniae	**Sensitive**- Norfloxacin, Colistin. **Resistant**-- Gen, AK, TE, Chloramphenicol, Ceftriaxone,Cefotaxime,CIP,COT,AMP/SULBACTAM, Intermediate- Ampicillin/TZ, IMP, MRP, OF, LE
67 yr	Female	COPD with Hypertension with Anaemia	No	No	General Surgery	Hernioplasty	< 7 d 3 days	Clean Contaminated	klebsiella Pneumoniae	**Sensitive--** COT,Ampicillin/Sulbactam, PIP/TZ, IMP, MRP, Cefttriaxone, Cefotaxime, CIP, Ofloxacin, LE, GEN, AK, TOB,TE,Chloramphenicol,POLYMYXIN B **Resistant --**COL, FO
52 yr	Male	Diabetes mellitus with COPD	Yes	No	General Surgery	Haemorrhoidectomy	<7 d 5 days	Contaminated	klebsiella Pneumoniae	**Sensitive**- OF, LE, **Resistant-** GE, AK, TOB, TE, CH, FO, Cefuroxime, Ertapenam, COT, Ampicillin/Sulbactam, PIP/TZ, MRP, Cefalexin, Ceftazidime, CIP
55 yr	Male	Diabetes Mellitus with Hypertension	No	Yes	General Surgery/ Critical Care	Exploratory Leprotomy	7-14 d 10 days	Contaminated	Escherichia Coli	**Senitive** - Amicillin/sulbactam, PIP/TZ, IMP, MRP, Ceftazidime, Cefaperazone/Sulbactam, Gen, Amikacin, COL. **Resistant--** COT, TE, Chloramphenicol,Norfloxacin, Ofloxacin,LE,Ceftriaxone,Cefotaxime, CIP
62 yr	Female	Diabetes Mellitus with Hypertension	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	klebsiella Pneumoniae	**Sensitive**- OF, LE, **Resistant**- GE, AK, TOB, TE, CH, FO, Cefuroxime, Ertapenam, COT, Ampicillin/Sulbactam, PIP/TZ, MRP, Cefalexin, Ceftazidime, CIP
65 yr	Male	Hpertension with Diabetes Mellitus	No	yes	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	Escherichia Coli	**Sensitive**- PIP/TZ, MRP, AK, COL, Ertapenam **Resistant**- ceftriaxone, CIP, MO, OF, GEN, IPM, COT, Amoxy/Clauvunic Acid,
72 yr	Female	Hpertension with Diabetes Mellitus	No	NO	General Surgery	Excision Biopsy	< 7 d 3 days	Clean	Staphylococcus Aureus	**Sensitive--** PIP/TZ, Cefotaxime, Cefoperazone/Sulbactam,CIP, OF, LE, GEN, AK, VAN, COT, DO, LZ,TGC, Ceftriaxone **RESISTANT** Cephelxin,Lincomycin, Ampi/sulbactam, TE, RO
42 yr	Male	Hypertension	Yes	yes	General Surgery	Fistulectomy	< 7 d 3 days	Dirty/infected	klebsiella Pneumoniae	**Sensitive**- OF, BA, LF, TZP, CH, AK, CP, CR, GEN, CFM, IPM, MRP, FO **Resistant**- AMC, AS
55 yr	Male	Anaemia with no Co- Morbidities	Yes	No	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	Klebsiella pneumoniae	**Sensitive**- OF, COL **Resistant-** Ertapenam, Ceftriaxone, TE, Amoxy/Clavunic Acid, AS, PIP/TZ, IMP, MRP, Cefuroxime
38 yr	Male	No Co- Morbidities	Yes	No	General Surgery	Fistulectomy	< 7 d 3 days	Clean Contaminated	Klebsiella pneumoniae	**Sensitive**- COT, Amoxy/ Clavunic Acid, AS, IPM, MRP, LE, GEN, AK, TOB, TE, Ertapenam. **Resistant**- Ceftaxime, cefotaxime, ceftazidime
24 yr	Male	No Co- Morbidities	yes	yes	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	klebsiella Pneumoniae	**Sensitive**- OF, LE, COT **Resistant**- Ceftriaxone, TOB, GEN, AK, TE, CH, COT, Amoxycillin, AS, PIP/Sulbactam, IMP, MRP, Cefotaxime, Cefperazone,/Sulbactam, CIP
26 yr	Female	No Co- Morbidities	No	No	Obstetrics& Gynaecology	Lower Segment Caesarian Section	12 days	Clean Contaminated	klebsiella Pneumoniae	**Sensitive**- TE,CH, Polymyxin B. **Resistant**- ceftriaxine, COT, Amoxycillin, AS, PIP/SULBACTAM, IPM, MRP, Cefotaxime, CIP, OF, LE
23 yr	Female	No Co- Morbidities	No	No	Obstetrics & Gynaecology	Lower segment caesarian section	<7 d 5 days	Clean Contaminated	Klebsiella pneumoniae	**Sensitive**- TGC. **Resistant**- Ceftriaxone, Amoxy/clauv, Ampi/Sulbactam, PIP/TZ, MRP,Cefaperazon/Sulbactam, Cefipime, CIP, GEN, AK, TE, Ertapenam
24 yr	Female	No Co- Morbidities	No	No	Obstetrics & Gynaecology	Lower segment caesarian section	< 7 d 3 days	Clean Contaminated	Klebsiella pneumoniae	**Sensitive-** IMP, MRP, COL, Ertapenam, AK, **Resistant**- TE, TGC, Ceftriaxone, COT, Amoxyclauv, Ampi/sulbactam, PIP/TZ, Cefipime, AZ, CIP, OF , LE, GEN
23 yr	Female	No Co- Morbidities	No	NO	General Surgery	Lumpectomy left Breast	< 7 d 3 days	Contaminated	klebsiella Pneumoniae	**Sensitive-** Ampicillin/sulbactam, PIP/TZ, IMP, MRP,Cefoperazone/Sulbactam, Gen, Fosfomycin, COL, **Resistant - -** COT, TE, Chloraphenicol, CIP, Norfloxacin, Ofloxacin, LE, Cefotaxime, Ceftazidime
21 yr	Male	No Co- Morbidities	Yes	No	Orthopaedics	Open reduction with internal Fixation left Humerus	<7 d 5 days	Contaminated	Klebsiella pneumoniae	**Sensitive**- TGC. **Resistant**- Ceftriaxone, Amoxy/clauv, Ampi/Sulbactam, PIP/TZ, MRP,Cefaperazon/Sulbactam, Cefipime, CIP, GEN, AK, TE, Ertapenam
32 yr	Female	No Comorbidities	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	klebsiella Pneumoniae	**Sensitive**- PIP/Sulbactam, IPM, MRP,TOB, FO, PO **Resistant**- Ceftriaxone, TE, CH, COT, Amoxycillin/Clavunic Acid, AS, Cefuroxime,Cefotaxime, Ceftazidime
20 yr	Female	Obstetric Risks	No	No	Obstetrics& Gynaecology	Emergency LSCS	>14 days 15 days	Clean Contaminted	klebsiella Pneumoniae	**Sensitive**- IPM, MRP,AMC, FO, LE, TZP, CH,AK,GM,AS,TGC **Resistant**- CP,CR,LE, TE, OF,BA, CF, CTX,CFM
32 yr	Female	Obstetric Risks No co-morbidities	No	No	Obstetrics & Gynaecology	Emergency Lower segment caesarian section	< 7 d 3 days	Clean Contaminated	Klebsiella pneumoniae	**Sensitive**- Polymyxin B**. Resistant-** Ceftriaxone, ETM, COT, AMC, MRP, CEFOXITINCIP, NX, OF, LE, GEN
64 yr	Female	A case of COPD with Hypertension	No	No	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
44 yr	Female	Hypertension	No	No	Obstetrics & Gynaecology	Total Abdominal Hysterectomy	7-14 d 14 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
58 yr	Male	COPD	Yes	No	General Surgery	Open Hernioplasty	<7 d 5 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
46 yr	Male	No Co - Morbidities	No	NO	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
22 yr	Female	No Co - Morbidities	NO	NO	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
22 yr	Male	No Co- Morbidities	Yes	No	General Surgery	Fistulectomy	7-14 d 8 days	Contaminated	No Growth after 48 hrs of Aerobic Incubation	
40 yr	Male	No Co- Morbidities	No	NO	General Surgery	Inguinal Herniography	<7 d 5 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
19 yr	Female	No Co- Morbidities	No	No	Obstetrics& Gynaecology	Lower segment Caesarian Section	7-14 d 12 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
45 yr	Male	No Co- Morbidities	No	NO	General Surgery	Open Hernioplasty	<7 d 5 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
34 yr	Male	No Co-Morbidities	No	NO	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
36 yr	Male	No Co-Morbidities	Yes	No	General Surgery	Cholecystectomy	<7 d 7 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	

40 yr	Female	No Co-Morbidities	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
28 yr	Female	No Co-Morbidities	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
26 yr	Female	No Co-Morbidities	No	No	General Surgery	Excision of Breast Fibroadenoma Left Breast	< 7 d 3 days	Clean	No Growth after 48 hrs of Aerobic Incubation	
27 yr	Female	Obstetric Risks No co-morbidities	No	No	Obstetrics & Gynaecology	Emergency Lower segment caesarian section	<7 d 5 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
36 yr	Female	Obstetric Risks No other Co-Morbidities	No	No	Obstetrics & Gynaecology	Lower Segement Caesarian section	<7 d 5 days	Clean Contaminated	No growth after 48 hrs of aerobic incubation	
28 yr	Male	No Co - Morbidities	Yes	No	General Surgery	Appendectomy	7-14 d 14 days	Contaminated	No growth after 48 hrs of aerobic incubation	
25 yr	Female	No Co - Morbidities	No	No	General Surgery	Cholecystectomy	<7 d 5 days	Clean contaminated	No growth after 48 hrs of aerobic incubation	
67 yr	Female	No Co - Morbidities	No	No	General Surgery	Cholescystectomy	< 7 d 3 days	Clean Contaminated	No growth after 48 hrs of aerobic incubation	
25 yr	Male	No Co - Morbidities	Yes	NO	General Surgery	Excision of Lipoma Abdomen	< 7 d 2days	Clean	No growth after 48 hrs of aerobic incubation	
42 yr	Male	No Co - Morbidities	No	NO	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	No growth after 48 hrs of aerobic incubation	
66 yr	Male	No Co - Morbidities	Yes	NO	General Surgery	Hernioplasty	< 7 d 3 days	Clean contaminated	No growth after 48 hrs of aerobic incubation	
20 yr	Female	No Co - Morbidities	No	No	Obstetrics & Gynaecology	Lower Segement Caesarian section	<7 d 5 days	Clean Contaminated	No growth after 48 hrs of aerobic incubation	
21 yr	Female	No Co - Morbidities	No	No	General Surgery	Lumpectomy Right Breast	< 7 d 2 days	Clean	No growth after 48 hrs of aerobic incubation	
52 yr	Female	No Co - Morbidities	No	NO	General Surgery	Cholescystectomy	4 days	Clean Contaminated	No Growth after 48 hrs of Aerobic Incubation	
28 yr	Female	No Co- Morbidities	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	No growth after 48 hrs of incubation	
36 yr	Male	Anaemia with No Co- Morbidities	No	NO	General Surgery	Gynacomastia excision	< 7 d 3 days	Clean	No growth after 48 hrs of incubation	
26 yr	Female	No Co- Morbidities	No	No	General Surgery	Right Gluteal Antibioma	< 7 d 3 days	Clean	No growth after 48 hrs of incubation	
43 yr	Male	Anaemia with No other Co-Morbidities	No	NO	General Surgery	Excision Biopsy Over Right Thigh	< 7 d 2 days	Contaminated	No Growth in culture Media after 48 HRs	
36 yr	Female	Obstetric Risks	NO	NO	Obstetrics & Gynaecology	Lower Segement Caesarian section	<7 d 7 days	Clean contaminated	No growth in culture Media after 48 hrs of aerobic incubation	
44 yr	Female	Anaemia with No other Co-Morbidities	No	NO	General Surgery	Cholecystectomy	7-14 days 9 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic Incubation	
50 yr	Female	CKD with Anaemia	No	No	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	No Growth in culture Media after 48 Hrs of Aerobic Incubation	
50 yr	Female	Hypertension With Anemia	No	No	General Surgery	Incisonal Hernioplsty	< 7 d 3 days	Clean Contaminated	No growth in culture Media after 48 hrs of aerobic incubation	
11 yr	Male	No Co- Morbidities	No	No	General Surgery	Herniotomy	< 7 d 3 days	Clean Contaminated	No growth in culture Media after 48 hrs of aerobic incubation	
22 yr	Male	No Co - Morbidities	No	No	General Surgery	Appendectomy	10 days	Contaminated	No Growth in culture Media after 48 Hrs of Aerobic Incubation	
59 yr	Female	No Co - Morbidities	No	No	General Surgery	Cholecystectomy	7 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic Incubation	
32 yr	Female	No Co - Morbidities	No	NO	General Surgery	Cholecystectomy	8 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic Incubation	
23 yr	Female	No Co - Morbidities	No	NO	General Surgery	Cholecystectomy	<7 d 5 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic Incubation	
40 yr	Male	No Co - Morbidities	No	NO	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	No growth in culture Media after 48 hrs of aerobic incubation	
49 yr	Male	No Co - Morbidities	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean contaminated	No growth in culture Media after 48 hrs of aerobic incubation	
50 yr	Male	No Co - Morbidities	No	NO	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	No growth in culture Media after 48 hrs of aerobic incubation	
46 yr	Male	No Co - Morbidities	No	No	General Surgery	Excision of Lipoma Abdomen	< 7 d 2days	Clean Contaminated	No growth in culture Media after 48 hrs of aerobic incubation	
60 yr	Male	No Co - Morbidities	Yes	No	General Surgery	Haemorrhoidectomy	<7 d 5 days	Clean Contaminated	No growth in culture Media after 48 hrs of aerobic incubation	
35 yr	Male	No Co - Morbidities	No	No	General Surgery	Hernioplasty	<7 d 5 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic Incubation	
56 yr	Male	K/C Of Hypertension	Yes	No	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	No growth in culture Media after 48 hrs of aerobic incubation	
38 yr	Male	No Co - Morbidities	No	NO	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	No growth in culture Media after 48 hrs of aerobic incubation	
23 yr	Female	other No Co -Morbidities	No	No	Obstetrics & Gynaecology	Lower Segement Caesarian section	<7 d 7 days	Clean Contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
26 yr	Female	Foetal distress No co-morbidities	NO	NO	Obstetrics & Gynaecology	Emergency LSCS	7 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
30 yr	Female	No Co - Morbidities	No	No	General Surgery	Appendectomy	10 days	Contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
70 yr	Female	K/C Of Hypertension with Anaemia	No	No	General Surgery	Cholecystectomy	7-14 d 10 days	Clean contaminated	No Growth in culture Media after 48 Hrs of aerobic Incubation	
70 yr	Male	CKD with Anaemia	No	No	General Surgery	Cholecystectomy	8 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	

28 yr	Male	No Co - Morbidities	No	No	General Surgery	Cholecystectomy	>14 days 16 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
62 yr	Male	No Co - Morbidities	No	No	General Surgery	Cholecystectomy	10 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
40 yr	Female	No Co - Morbidities	No	NO	General Surgery	Cholecystectomy	7-14 d 12 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
17 yr	Female	No Co - Morbidities	NO	NO	General Surgery	Excision of Lipoma (forehead)	< 7 d 2days	Clean	No Growth in culture Media after 48 Hrs of Aerobic incubation	
25 yr	Male	No Co - Morbidities	No	No	General Surgery	Exploratory Laparotomy	>14 days 21 days	Contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
55 yr	male	No Co - Morbidities	No	No	General Surgery/ Critical Care	Exploratory Laprotomy	> 14 days 16 days	Contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
48 yr	Male	No Co - Morbidities	No	No	General Surgery	Hernioplasty	7-14 d 8 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
30 yr	Male	No Co - Morbidities	No	NO	General Surgery	Hernioplasty	7-14 d 8 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
25 yr	Female	Obstetric Risks	No	NO	Obstetrics & Gynaecology	Lower Segement Caesarian section	7-14 d 12 days	Clean contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
22 yr	Female	No Co - Morbidities	No	No	Orthopaedics	Open reduction with internal Fixation left Humerus	10 days	Contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
42 yr	Female	No Co - Morbidities	No	No	Orthopaedics	Open reduction with Internal Fixation left Tibia	8 days	Contaminated	No Growth in culture Media after 48 Hrs of Aerobic incubation	
20 yr	Male	No Co- Morbidities	Yes	No	Orthopaedics	Right Lateral Meniscus tear ACL reconstruction with Balacing	<7 d 5 days	Contaminated	No Growth in Culture Media after 48 hrs of Aerobic Incubtaion	
50 yr	Female	No Co - Morbidities	No	No	General Surgery	Cholecystetomy	8 days	Clean Contaminted	No Growth in Culture Media after 48 hrs of Aerobic Incubtaion	
23 yr	Female	No Co - Morbidities	No	No	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	No Growth in Culture Media after 48 hrs of Aerobic Incubtaion	
50 yr	Female	Anaemia with Hypertension	No	No	General Surgery	Cholescystectomy	<7 d 5 days	Clean Contaminated	Pesudomonas Aeruginosa	**Sensitive**- PIP/TZ, IMP, MRP, GEN, AK, Intermediate- TE **Resistant**- COT, Ampicillin/Sulbactam, Cefuroxime,CFM, CIP, Ceftrixone
29 yr	Female	Anaemia with No other Co-Morbidities	No	No	General Surgery	Exploratory Laparotomy	> 14 d 15 days	Contaminated	Pesudomonas Aeruginosa	**Sensitive**- PIP/TZ, IMP, MRP, GEN, AK, Intermediate- TE **Resistant**- COT, Ampicillin/Sulbactam, Cefuroxime,CFM, CIP, Ceftrixone
50 yr	Female	Anaemia, Hypertension With DM	No	No	General Surgery	Hernioplasty	7-14 d 12 days	Clean Contaminated	Pesudomonas Aeruginosa	**Sensitive**- Ceftazidime, Cefipime, AK, TOB,Choramphenicol, polymyxin B **Resistant**- Ceftriaxone, CIP, OF, LE, GEN, COT
70 yr	Male	COPD, Hypertension with Type -2 Diabetes with Anaemia	Yes	yes	General Surgery	Hernioplasty	< 7 d 3 days	Clean Contaminated	Pesudomonas Aeruginosa	**Sensitive**- Ceftazidime, Cefipime, AK, TOB,Choramphenicol, polymyxin B **Resistant**- Ceftriaxone, CIP, OF, LE, GEN, COT
52 yr	Female	Hpertension, Diabetes Mellitus with Anaemia	No	No	General Surgery	Cholescystectomy with CBD Exploration with stent Removal	7-14 d 15 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**sensitive**-Cloxacillin, AS, Cefalexin, LE, GEN, VAN, TE, LZ, CD, Lincomycin. **Resistant**- COT, PEN G, AZ, Roxithromycin, CIP, Cefoxitin
32 yr	Male	No Co- Morbidities	No	yes	Orthopaedics	Open reduction with internal Fixation	<7 d 7 days	Dirty/ Infected	Pesudomonas Aeruginosa	**Sensitive**- PIP/TZ, IPM, MRP, Cefotaxime, CIP, OF , LE, GEN, AK, TE **Intermediate**- Ceftazidime **Resistant**- Ceftriaxone, COT, Ampicillin/Clavunic Acid, AS, Cefuroxime
34 yr	Female	No other Co- Morbidities	No	No	Obstetrics& Gynaecology	Emergency LSCS	> 14 days 17 days	Clean Contaminated	Proteus Mirabilis	**Sensitive**- Amoxycillin/clavunic acid, Ampicillin/sulbactam, PIP/TZ, IMP, MRM, Cefotaxime, GEN, AK, CH **Resistant**- TOB,TE, CFZ, CIP, OF, CXM,
68 yr	Male	COPD, Hypertension	Yes	yes	General Surgery/ Critical Care	Trauma With Multiple Injuries	7-14 d 14 days	Dirty/ Infected	Proteus Mirabilis	**Sensitive**- Amoxycillin/clavunic acid, Ampicillin/sulbactam, PIP/TZ, IMP, MRM, Cefotaxime, GEN, AK, CH **Resistant**- TOB,TE, CFZ, CIP, OF, CXM,
64 yr	Female	Hpertension, DM with Anaemia	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Proteus Mirabilis	**Sensitive**- OF, LE, COL, TGC **Resistant**- Ceftriaxone Axetil, Ertapenam, GEN, TE, COT, Amoxy/Clauv, Ampi/Sulbactam, PIP/TZ, IMP, MRP
55 yr	Male	CAD with Hypertension	Yes	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Proteus vulgaris	I**ntrinsic Resistance**- Colistin, Polymyxin B **Sensitive**- CIP, OF, LE,GEN, AK, TOB, TE, Amoxycillin/Clavunic Acid **Resistant**- COT, Ceftazidime, Cefuroxime,
70 yr	Female	Hypertension Diabetes, Mellitus with Anaemia	NO	NO	Orthopaedics	Total Hip Replacement	7-14 d 14 days	Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive**- CIP, LE, VAN, LZ, Clindamycin Intermediate- Cloxacillin **Resistant**- Lincomycin, Cephalexin, GE, COT, Penicillin G, Ampicillin/Sulbactam, Cefoxitin, Cefotaxime, AZ, RX
66 yr	Male	Hypertension with Diabetes mellitus	Yes	yes	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	Klebsiella oxytoca	**Sensitive**- PIP/TZ,CH, FO, POLYMYXIN, COL. Intermediate- LE, GEN, AK, CLOXACILLIN **Resistant**- Ceftriaxone, COT, Amoxycillin, AS Cefotaxime, CIP, OF
24 yr	Female	Obstetric Risks	No	No	Obstetrics & Gynaecology	Lower Segement Caesarian section	< 7 d 3 days	Clean Contaminated	staphylococcus Aureus	**Sensitive**- CIP, LE, VA, TE, LZ **Resistant**- Lincomycin,Cephalexin, GEN, COT, Penicillin, Ampicillin/Sulbactam, Cefoxitin, Cefotaxime,AZ, Roxithromycin I- Cloxacillin
23 yr	Female	A Case of Anaemia	No	No	Obstetrics & Gynaecology	Lower segment ceasarian section	< 7 d 3 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive**- TE, LZ, TGC **Resistant**- Nitrofurantoin, CD, COT,PEN G, Erythromycin,CIP, GEN, VA
21 yr	Female	Anaemia with No Co- Morbidities	No	No	General Surgery	Appendectomy	7-14 d 14 days	Contaminated	Staphylococcus Aureus (MRSA)	**sensitive**-Cloxacillin, AS, Cefalexin, LE, GEN, VAN, TE, LZ, CD, Lincomycin. . **Resistant**- COT, PEN G, AZ, Roxithromycin, CIP, Cefoxitin
31 yr	Female	Anaemia with No other Co-Morbidities	No	No	Obstetrics & Gynaecology	Lower Segement Caesarian section	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive**- CIP, LE, VAN, LZ, Clindamycin Intermediate- Cloxacillin **Resistant**- Lincomycin, Cephalexin, GE, COT, Penicillin G, Ampicillin/Sulbactam, Cefoxitin, Cefotaxime, AZ, RX
29 yr	Female	Anaemia with No other Co-Morbidities	No	No	Obstetrics & Gynaecology	Lower segment ceasarian	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive**- TE, LZ, TGC **Resistant**- Nitrofurantoin, CD, COT,PEN G, Erythromycin,CIP, GEN, VA

24 yr	Female	Anemia with Obstetric Risks	No	No	Obstetrics & Gynaecology	Lower segment caesarian section	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive**- CIP, LE, VAN, LZ, Clindamycin Intermediate- Cloxacillin **Resistant**- Lincomycin, Cephalexin, GE, COT, Penicillin G, Ampicillin/Sulbactam, Cefoxitin, Cefotaxime, AZ, RX
50 yr	Female	CAD with Hypertension	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive-** COT, Cloxacillin, GEN, TE, LZ, Clindamycin, Ertapenam, TG**C Resistant**- Ceftazidime, Ciprofloxacin, PEN G, Benzyl Penicillin,
60 yr	Female	Hypertension with Diabetes mellitus	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- CF, LF, LZ, CX, AS, PR, GM, TE, LM, CX, MO, COX, PIT, VA, TGC **Resistant**- COT, CP, RF, BA
43 yr	Female	Hypertension	No	No	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- LE, GEN, VA, TE, DO, LZ, Clindamycin, Lincomycin, COT, Cloxacillin, Amoxy/ clauv, Ampi/Sulbactam, Cefotaxime. **Resistant**- RO, CIP, Cephalexin
42 yr	Male	Hypertension with Type -2 Diabetes Mellitus	No	yes	General Surgery	Appendectomy	> 14 days15 days	Contaminated	klebsiella Pneumoniae	**Sensitive**- PIP/Sulbactam, IPM, MRP,TOB, FO, PO **Resistant**- Ceftriaxone, TE, CH, COT, Amoxycillin/Clavunic Acid, AS, Cefuroxime,Cefotaxime, Ceftazidime
65 yr	Female	Hypertension With Anemia	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive**- CIP, LE, VAN, LZ, Clindamycin Intermediate- Cloxacillin **Resistant**- Lincomycin, Cephalexin, GE, COT, Penicillin G, Ampicillin/Sulbactam, Cefoxitin, Cefotaxime, AZ, RX
74 yr	Male	Hypertension with CAD with Anaemia	Yes	No	General Surgery	Hernioplasty	< 7 d 3 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive-** CIP, LE, VAN, LZ, Clindamycin Intermediate- Cloxacillin **Resistant-** Lincomycin, Cephalexin, GE, COT, Penicillin G, Ampicillin/Sulbactam, Cefoxitin, Cefotaxime, AZ, RX
50 yr	Female	Hypertension, COPD with Anaemia	No	No	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**sensitive**-Cloxacillin, AS, Cefalexin, LE, GEN, VAN, TE, LZ, CD, Lincomycin**. Resistant**- COT, PEN G, AZ, Roxithromycin, CIP, Cefoxitin
25 yr	Male	No Co- Morbidities	No	yes	General Surgery	Hernioplasty	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive** - COT, Amoxy/clauv, Amp/Sulbatcam, PIP/Sulbactam, **Resistant**--Cefoxitin,Cefuroxime, RO,LE, GEN, TOB, VA,TE,DO, LZ,Lincomycin
40 yr	Male	No Co- Morbidities	No	yes	General Surgery	Hernioplasty	< 7 d 3 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive**- Ampicillin/sulbactam, LE, VA **Resistant**- TE, LZ, Clindamycin, Lincomycin, Cephelexin, GEN, COT, Pencillin G, Cloxacillin, cefoxitin, cefotaxime, AZ, Roxithramycin, CIP, Oxacillin
40 yr	Female	Obstetric Risks	No	No	General Surgery	Cholecystectomy	<7 d 7 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive**- LE, CH, COL Intermediate- OF **Resistant**- GEN, AK, TOB, TE, COT, Amoxycillin/Clavunic Acid, Ampicillin/Sulbactam, PIP/TZ , IMP, MRP, Cefalexin, CIP
35 yr	Female	Obstetric Risks	No	No	Obstetrics & Gynaecology	Lower segment caesarian section	< 7 d 3 days	Clean Contaminated	Staphylococcus Aureus (MRSA)	**Sensitive**- CIP, LE, VA, TE, LZ **Resistant**- Lincomycin,Cephalexin, GEN, COT, Penicillin, Ampicillin/Sulbactam, Cefoxitin, Cefotaxime,AZ, Roxithromycin I- Cloxacillin
21 yr	Female	Anaemia with No Co- Morbidities	No	No	Obstetrics & Gynaecology	Lower segment ceasarian Sestion	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- Cefalexin, Cefoxitin, CIP, LE, GEN, VA, LZ, CD **Resistant-** COT, AS, TE, AZ
24 yr	Female	Anaemia with No Co- Morbidities	No	No	General Surgery	Appendicectomy	<7 d 7 days	Contaminated	Staphylococcus Aureus (MSSA)	**Senstitive**- COT, COX, E, LE, GEN, VA, TE, LZ, LD, TGC **Resistant**- CIP, PEN G
25 yr	Female	Anaemia with No Co- Morbidities	No	No	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- AMC, AS, PIP/TZ, CN, LE, GEN TE, LZ, CN **Resistant**- COT, COX, L, AZM, CIP
32 yr	Female	Anaemia with Obstetric Risks	No	No	Obstetrics & Gynaecology	Lower segment ceasarian Sestion	7-14 d 10 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- Cefalexin, Cefoxitin, CIP, LE, GEN, VA, LZ, CD **Resistant-** COT, AS, TE, AZ
35 yr	Female	Anaemia with Obstetric Risks	No	No	Obstetrics& Gynaecology	Lower Segement Caesarian section	6 days	Clean Contaminted	Staphylococcus Aureus (MSSA)	**Sensitive**- CX, CFS, AK,AS, GM, CF, CP,LE. **Resistant**- BA, PR, TE, LM, RF, LZ, VA,COX, MO
55 yr	Male	COPD with Anaemia	Yes	NO	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**-Cloxacillin, Cefoxtinn, AZ, CIP, LE, GEN., VAN, TE, LE, LZ, Clindamycin, COT. **Resistant-** Penicillin G
46 yr	Male	Hypertension with Anaemia	No	yes	General Surgery	Exploratory Laparotomy	10 days	Dirty/ Infected	Staphylococcus Aureus (MSSA)	**Sensitive**- COT, Cloxacillin, Ampi/Sulbactam, Cefoxitine, RO, CIP, LE, GEN, LZ,Lincomycin, TGC, Piperacillin, TOB, Cefalexin
48 yr	Male	Hypertension with Bronchial Asthma	No	No	General Surgery	Open Hernioplasty	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- VA, TE, LZ, CD, Lincomycin, Cephalexin, GEN, COT, PEN G, Cloxacillin, AS, Cefotaxime, AZ, CIP I- LE
62 yr	Male	Hypertension with CAD	Yes	No	General Surgery	Cholecystectomy	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- LE, GEN, VA, TE, DO, LZ, Clindamycin, Lincomycin, COT, Cloxacillin, Amoxy/ clauv, Ampi/Sulbactam, Cefotaxime. **Resistant**- RO, CIP, Cephalexin
62 yr	Male	Hypertension with COPD	Yes	yes	General Surgery	Cholecystectomy	7-14 d 12 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- AS, BA, TE,CF, CP, LE, LZ, RF, LM, GM CX, VA CLR Intermediate-AK, MO, CFS, AMC **Resistant**- CFR, CX, PR
75yr	Female	Hypertension, Diabetes Mellitus with Anaemia	No	No	Orthopaedics	Total Hip Replacement	> 14 days 17 days	Contaminated	Pseudomonas Aeroginosa	**Senitive** - TZP,AK,GM, IMP, MRP,PTT **Resistant**- AS, BA,CH,CP,CR,TE,FO,LE.AMC, COT,CPM,CPX
50 yr	Female	Hypertension, with Anaemia	No	No	General Surgery	Cholecystectomy	7 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- AS, BA, TE,CF, CP, LE, LZ, RF, LM, GM CX, VA CLR Intermediate-AK, MO, CFS, AMC **Resistant**- CFR, CX, PR
11 yr	Male	No Co- Morbidities	No	No	General Surgery	Appendectomy	7-14 d 14 days	Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- Cloxacillin, LE, GEN, TE, LZ, Clindamycin, TGC **Resistant**- Erythromycin, CIP, COT, Penicillin
23 yr	Female	No Co- Morbidities	No	No	Obstetrics& Gynaecology	Emergency Lower Segement Caesarian section	>14 days 16 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- VA, TGC, LZ, RF, CX, BA, PR, GM, TE, LM, CP, LE, RF Intermediate- PIT, AMC
23 yr	Female	No Co- Morbidities	No	No	Obstetrics & Gynaecology	Emergency Lower segemet caesarian Section	7-14 d 10 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- AS, Cefotaxime, CIP, LE, GEN, TOB, VAN, TE, DO, LZ, LIN, TGC, COT, Cloxacillin
20 yr	Female	No Co- Morbidities	No	No	Obstetrics& Gynaecology	Lower segemet caesarian Section	9 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- AS, LZ, LE, CF, PR, GM, CFS, AMC, VA, AK, MO, CX, CEFOXITIN. **Resistant**- CLR, BA, TE, LP, LM, RF,CX
34 yr	Female	No Co- Morbidities	No	No	Obstetrics & Gynaecology	Lower segment caesarian section	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- COT, COX, AMC, AS, CN, CTX, CX
25 yr	Female	No Co- Morbidities	No	No	Obstetrics & Gynaecology	Lower segment ceasarian	<7 d 7 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- COT, COX, AMC, AS, CN, CTX, CX
19 yr	Male	No Co- Morbidities	No	yes	Orthopaedics	Open reduction with internal Fixation	7-14 d 14 days	Dirty/ Infected	Staphylococcus Aureus (MSSA)	**Sensitive**-Cloxacillin, Cefoxtinn, AZ, CIP, LE, GEN., VAN, TE, LE, LZ, Clindamycin, COT. **Resistant-** Penicillin G

32 yr	Female	No Co- Morbidities	No	No	Orthopaedics	Open reduction with internal Fixation left Tibia	10 days	Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive-** CF, LF, LZ, CX, AS, PR, GM, TE, LM, CX, MO, COX, PIT, VA, TGC **Resistant**- COT, CP, RF, BA
21 yr	Male	No Co- Morbidities	No	No	Orthopaedics	Open reduction with internal Fixation Right Tibia	<7 d 5 days	Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- LE, GEN, VA, TE, DO, LZ, Clindamycin, Lincomycin, COT, Cloxacillin, Amoxy/ clauv, Ampi/Sulbactam, Cefotaxime. **Resistant**- RO, CIP, Cephalexin
23 yr	Female	No Co- Morbidities	No	No	Orthopaedics	Osteomyelitis	<7 d 7 days	Dirty/ Infected	Staphylococcus Aureus (MSSA)	**Sensitive**- LE, GEN,VA, TE, DO, LZ, TGC, PIP/TZ, RO, TOB, Cephalexin. **Resistant**- CIP, Cefotaxime, COT, cloxacillin, AMP/Sulbactam, Ceftriaxone
42 yr	Female	No Co- Morbidities	No	No	Obstetrics & Gynaecology	Total Abdominal Hysterectomy	14 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- VA, TGC, LZ, RF, CX, BA, PR, GM, TE, LM, CP, LE, RF **Intermediate**- PIT, AMC
18 yr	Male	No Co-Morbidity	Yes	Yes	General Surgery	Exploration of right thigh with muscle biopsy	<7 d 5 days	Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- CX, CFS, AK,AS, GM, CF, CP,LE. **Resistant**- BA, PR, TE, LM, RF, LZ, VA,COX, MO
23 yr	Female	Obstetric Risks	NO	NO	Obstetrics& Gynaecology	Lower Segement Caesarian section	4 days	Clean Contaminted	Staphylococcus Aureus (MSSA)	**Sensitive**- COT,Cefoxitin, RF, CP, LE,GM, Vancomycin, TE, LZ, Lincomycin, TGC, Cefalexin, **Resistant**-Cefixime,cefotaxime,AM/S
29 yr	Female	Obstetric risks Anaemia	No	No	Obstetrics & Gynaecology	Lower Segement Caesarian section	<7 d 5 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- VA, TE, LZ, CD, Lincomycin, Cephalexin, GEN, COT, PEN G, Cloxacillin, AS, Cefotaxime, AZ, CIP. **Intermediate** LE
26 y	Female	Obstetric Risks co-morbidities	No	No	Obstetrics & Gynaecology	Lower Segement Caesarian section	< 7 d 3 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- VA, TE, LZ, CD, Lincomycin, Cephalexin, GEN, COT, PEN G, Cloxacillin, AS, Cefotaxime, AZ, CIP **I**- LE
63 yr	Female	Hypertension,Diabetes Mellitus with Anaemia	No	No	General Surgery	Cholecystectomy	> 14 days 15 days	Clean contaminated	Escherichia Coli	**Sensitive**- CH, AK, GM, TE, LE, NIT, PIT, MRP, IPM **Resistant**- CP, CR, AS, OF, BA, CF, TZP, CN, AP, AMC
40 yr	Female	No Co - Morbidities	No	No	General Surgery	Cholecystectomy	< 7 d 3 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- COT, Cloxacillin, Ampi/Sulbactam, Cefoxitine, RO, CIP, LE, GEN, LZ,Lincomycin, TGC, Piperacillin, TOB, Cefalexin
22 yr	Female	Obstetric Risks	No	No	Obstetrics& Gynaecology	Emergency Lower Segement Caesarian section	> 14 days 16 days	Clean Contaminated	Staphylococcus Aureus (MSSA)	**Sensitive**- AS, LZ, LE, CF, PR, GM, CFS, AMC, VA, AK, MO, CX, CEFOXITIN. **Resistant**- CLR, BA, TE, LP, LM, RF,CX